

**SITE REASSESSMENT
FOR
COLUMBIA FALLS ALUMINUM COMPANY
ALUMINUM SMELTER FACILITY
COLUMBIA FALLS, FLATHEAD COUNTY, MONTANA**

Prepared for
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 8

Prepared by
WESTON SOLUTIONS, INC.
Region 8 Superfund Technical Assessment and Response Team

April 2014

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TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
1.1	Project Objectives	1
1.2	Project Scope	1
2.0	SITE BACKGROUND	2
2.1	Location	2
2.2	Site Description.....	2
2.1	Physical Characteristics	2
2.1.1	Regional Climate	2
2.1.2	Geologic and Hydrologic Setting.....	3
2.1.3	Geologic Setting.....	3
2.1.4	Hydrologic Setting.....	3
2.1.5	Hydrogeologic Setting	4
	2.1.5.1 Stratigraphy	4
	2.1.5.2 Groundwater Depth and Flow Direction.....	5
2.1.6	Vegetation and Wildlife.....	7
	2.1.6.1 Threatened and Endangered Species.....	7
2.2	Operational History.....	8
2.3	Current Site Conditions.....	8
2.4	Previous Investigations/Regulatory Involvement	13
3.0	CURRENT INVESTIGATION	15
3.1	Sample Locations and Methodologies	15
3.2	Groundwater Elevations.....	20
3.3	Sample Collection	21
3.3.1	Groundwater Sampling.....	22
	3.3.1.1 Background Groundwater Samples	23
	3.3.1.2 Opportunity Groundwater Samples	23
3.3.2	Surface Water Sampling	23
	3.3.2.1 Background Surface Water Samples.....	24
3.3.3	Sediment Sampling	24
	3.3.3.1 Background Sediment Samples	25
	3.3.3.2 Opportunity Sediment Samples	25
3.3.4	Soil Sampling.....	25
	3.3.4.1 Background Soil Samples	26
3.4	Deviations from Sampling Plan	Error! Bookmark not defined.
3.5	Quality Control	29
3.5.1	Field Duplicates	29
3.5.2	Matrix Spike/Matrix Spike Duplicates	29
3.5.3	Equipment Blanks	29
3.5.4	Field Blanks	29
3.5.5	Trip Blanks.....	30

W0004.1A.00115

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3.6	Screening Benchmarks.....	31
4.0	INVESTIGATION RESULTS.....	32
4.1	Source Sample Results.....	33
4.1.1	Waste Source Results.....	33
4.1.2	Source Surface Water and Waste Sediment Results.....	34
4.1.2.1	Surface Water.....	34
4.1.2.2	Waste Sediment.....	35
4.1.3	South Percolation Ponds Source Surface Water and Waste Sediment Results.....	35
4.1.3.1	Surface Water.....	35
4.1.3.2	Waste Sediment.....	36
4.2	Groundwater Sample Results.....	37
4.2.1	Background Groundwater Results.....	37
4.2.2	Site Groundwater Results.....	37
4.2.2.1	Total TAL Metals.....	38
4.2.2.2	Dissolved TAL Metals.....	39
4.2.2.3	General Chemistry.....	41
4.2.3	Residential Groundwater Results.....	41
4.2.3.1	Total TAL Metals.....	42
4.2.3.2	Dissolved TAL Metals.....	42
4.2.3.3	General Chemistry.....	43
4.3	Surface Water Sample Results.....	43
4.3.1	Cedar Creek Background Surface Water Results.....	43
4.3.2	Cedar Creek Surface Water Results.....	44
4.3.2.1	Total TAL Metals.....	44
4.3.2.2	Dissolved TAL Metals.....	45
4.3.3	Flathead River Background Surface Water Results.....	45
4.3.4	Flathead River Surface Water Results.....	45
4.3.4.1	Total TAL Metals.....	46
4.3.4.2	Dissolved TAL Metals.....	46
4.3.4.3	General Chemistry.....	47
4.4	Sediment Sample Results.....	47
4.4.1	Cedar Creek Background Sediment Results.....	47
4.4.2	Cedar Creek Sediment Results.....	47
4.4.3	Cedar Creek Reservoir Overflow Drainage Background Sediment Results.....	48
4.4.4	Cedar Creek Overflow Drainage Sediment Results.....	48
4.4.5	Flathead River Background Sediment Results.....	48
4.4.6	Flathead River Sediment Results.....	49
4.4.6.1	Total TAL Metals.....	49
4.4.6.2	General Chemistry.....	50
4.5	Soil Sample Results.....	50
4.5.1	Background Soil Results.....	50
4.5.2	Site Soil Results.....	50

W0004.1A.00115

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4.6	Data Gaps.....	50
4.7	Environmental and/or Human Impact.....	51
4.8	Data Quality Assessment.....	53
5.0	MIGRATION PATHWAY ANALYSIS.....	59
5.1	Sources of Contamination.....	59
5.2	Groundwater Pathway.....	60
5.2.1	Groundwater Receptors.....	61
5.2.2	Groundwater Pathway Conclusions.....	62
5.3	Surface Water Pathway.....	62
5.3.1	Surface Water Receptors.....	62
5.3.2	Surface Water Pathway Conclusions.....	63
5.4	Soil Exposure and Air Pathways.....	64
5.4.1	Soil and Air Exposure Pathway Receptors.....	64
5.4.2	Soil and Air Exposure Pathway Conclusions.....	66
6.0	INVESTIGATION SUMMARY.....	67
6.1	Conclusions.....	69
7.0	REFERENCES.....	70

LIST OF TABLES

Table 1	Observed Site Features	9
Table 2	Columbia Falls Aluminum Company Site Collected Sample Quantities	16
Table 3	Wells within Four-Mile Radius and Population Served	61
Table 4	Population within Four-Mile Radius	65
Table 5	Acres of Wetland within Four-Mile Radius.....	65

LIST OF FIGURES

Figure 1	Site Location Map
Figure 2	Site Features Map
Figure 3	Potentiometric Contour Map
Figure 4	Sample Locations Map
Figure 5	Groundwater Sample Locations Map
Figure 6	Surface Water and Sediment Sample Locations Map
Figure 7	Soil Sample Locations Map

W0004.1A.00115

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APPENDICES

Appendix A	Well Logs
Appendix B	Photograph Log
Appendix C	Field Data Tables
	Table C1 Sample Location, Feature Descriptions, and GPS Coordinate Data
	Table C2 Groundwater Elevation Measurements
Appendix D	Field Documentation
Appendix E	Data Summary Tables
	Table E1 Source Ground Water VOCs Analytical Results Summary
	Table E2 Source Ground Water SVOCs Analytical Results Summary
	Table E3 Source Ground Water PAHs Analytical Results Summary
	Table E4 Source Ground Water Pesticides Analytical Results Summary
	Table E5 Source Ground Water PCBs Analytical Results Summary
	Table E6 Source Ground Water TAL Metals Analytical Results Summary
	Table E7 Source Ground Water Dissolved Metals Analytical Results Summary
	Table E8 Source Ground Water General Chemistry Analytical Results Summary
	Table E9 Source Surface Water VOCs Analytical Results Summary
	Table E10 Source Surface Water SVOCs Analytical Results Summary
	Table E11 Source Surface Water PAHs Analytical Results Summary
	Table E12 Source Surface Water Pesticides Analytical Results Summary
	Table E13 Source Surface Water PCBs Analytical Results Summary
	Table E14 Source Surface Water TAL Metals Analytical Results Summary
	Table E15 Source Surface Water Dissolved Metals Analytical Results Summary
	Table E16 Source Surface Water General Chemistry Analytical Results Summary
	Table E17 Source Sediment VOCs Analytical Results Summary
	Table E18 Source Sediment SVOCs Analytical Results Summary
	Table E19 Source Sediment PAHs Analytical Results Summary
	Table E20 Source Sediment Pesticides Analytical Results Summary
	Table E21 Source Sediment PCBs Analytical Results Summary
	Table E22 Source Sediment TAL Metals Analytical Results Summary
	Table E23 Source Sediment General Chemistry Analytical Results Summary
	Table E24 Ground Water VOCs Analytical Results Summary
	Table E25 Ground Water SVOCs Analytical Results Summary
	Table E26 Ground Water PAHs Analytical Results Summary
	Table E27 Ground Water Pesticides Analytical Results Summary
	Table E28 Ground Water PCBs Analytical Results Summary

W0004.1A.00115

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Table E29	Ground Water TAL Metals Analytical Results Summary
Table E30	Ground Water Dissolved Metals Analytical Results Summary
Table E31	Ground Water General Chemistry Analytical Results Summary
Table E32	Surface Water VOCs Analytical Results Summary
Table E33	Surface Water SVOCs Analytical Results Summary
Table E34	Surface Water PAHs Analytical Results Summary
Table E35	Surface Water Pesticides Analytical Results Summary
Table E36	Surface Water PCBs Analytical Results Summary
Table E37	Surface Water TAL Metals Analytical Results Summary
Table E38	Surface Water Dissolved Metals Analytical Results Summary
Table E39	Surface Water General Chemistry Analytical Results Summary
Table E40	Sediment VOCs Analytical Results Summary
Table E41	Sediment SVOCs Analytical Results Summary
Table E42	Sediment PAHs Analytical Results Summary
Table E43	Sediment Pesticides Analytical Results Summary
Table E44	Sediment PCBs Analytical Results Summary
Table E45	Sediment TAL Metals Analytical Results Summary
Table E46	Sediment General Chemistry Analytical Results Summary
Table E47	Soil VOCs Analytical Results Summary
Table E48	Soil SVOCs Analytical Results Summary
Table E49	Soil PAHs Analytical Results Summary
Table E50	Soil Pesticides Analytical Results Summary
Table E51	Soil PCBs Analytical Results Summary
Table E52	Soil TAL Metals Analytical Results Summary
Table E53	Soil General Chemistry Analytical Results Summary
Table E54	Quality Assurance Water VOCs Analytical Results Summary
Table E55	Quality Assurance Water SVOCs Analytical Results Summary
Table E56	Quality Assurance Water PAHs Analytical Results Summary
Table E57	Quality Assurance Water Pesticides Analytical Results Summary
Table E58	Quality Assurance Water PCBs Analytical Results Summary
Table E59	Quality Assurance Water TAL Metals Analytical Results Summary
Table E60	Quality Assurance Water Dissolved Metals Analytical Results Summary
Table E61	Quality Assurance Water General Chemistry Analytical Results Summary

Appendix F Laboratory Analytical and Data Validation Reports

W0004.1A.00115

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LIST OF ACRONYMS

°C	degrees Celsius
amsl	above mean sea level
ARCO	Atlantic Richfield Company
bgs	below ground surface
btoc	below top of casing
CA	Corrective Action
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CFAC	Columbia Falls Aluminum Company
CLP	Contract Laboratory Program
COC	Contaminants of Concern
CR	County Road
DEQ	Montana Department of Environmental Quality
ECOS	Environmental Conservation Online System
EPA	U.S. Environmental Protection Agency
ESAT	Environmental Services Assistance Team
FWP	Montana Fish, Wildlife & Parks
FID	flame ionization detector
ft	foot
gpd	gallons per day
gpm	gallons per minute
GPS	global positioning system
HRS	Hazard Ranking System
IPaC	Information, Planning, and Conservation System
MBMG	Montana Bureau of Mines and Geology
MDHES	Montana Department of Health and Environmental Sciences
MFISH	Montana Fisheries Information System
MNHP	Montana National Heritage Program
MS	matrix spike
MSD	matrix spike duplicate
MT	Montana
NFRAP	No Further Remedial Action Planned
NPL	National Priorities List
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PID	photoionization detector
PM	Project Manager
PPE	Personal Protective Equipment

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LIST OF ACRONYMS (CONTINUED)

ppm	parts per million
QAPP	Quality Assurance Project Plan
SAM	Site Assessment Manager
SAP	Sampling and Analysis Plan
SI	Site Inspection
SOP	Standard Operating Procedure
SS	surface soil
START	Superfund Technical Assessment and Response Team
SVOC	semi-volatile organic compound
SWPPP	Storm Water Pollution Prevention Plan
TAL	Target Analyte List
TDD	Technical Direction Document
TSCA	Toxic Substances Control Act
USFWS	U.S. Fish & Wildlife Service
USGS	United States Department of the Interior Geologic Survey
VOC	volatile organic compound
WESTON	Weston Solutions, Inc.

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1.0 INTRODUCTION

This Site Reassessment Report (SRR) for the Anaconda Aluminum Company (a.k.a Columbia Falls, Aluminum Company [CFAC]) site (the “Site”), (Comprehensive Environmental Response, Compensation and Liability Information System [CERCLIS] ID# MTD057561763), in Flathead County, Montana (Figure 1) has been prepared to partially satisfy the requirements of Technical Direction Document (TDD) No. 1305-04 issued to Weston Solutions, Inc. (WESTON) under the U.S. Environmental Protection Agency (EPA) Region 8 Superfund Technical Assessment and Response Team (START) Contract No. EP-S8-13-01. This report has been prepared in accordance with the EPA “Guidance for Performing Site Inspections under CERCLA,” Interim Final, September 1992, and the “Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA” (EPA 1992; EPA 1993). This report addresses field sampling activities conducted from September 23 through October 1, 2013, at the CFAC Site. Field activities followed the Site Inspection (SI) format, applicable START Standard Operating Procedures (SOPs), and the Quality Assurance Project Plan (QAPP) (WESTON 2013a; WESTON 2013b).

This SRR is intended to be used in conjunction with the CFAC Sampling and Analysis Plan (SAP) (WESTON, 2013a).

1.1 PROJECT OBJECTIVES

The purpose of this investigation is to:

- Characterize the hydrogeological conditions at the Site.
- Evaluate source area(s) and contaminant characteristics of source area(s) at the Site and evaluate the source area(s) by Hazard Ranking System (HRS) criteria.
- Collect samples and associated analytical data to confirm a release, or threat of a release of a hazardous substance to the environment.
- Identify the contaminants of concern (COCs) at the Site.
- Identify the potential targets or receptors (human and ecological) that may be impacted, and pathways by which they may be or are being transmitted.
- Determine if potential targets or receptors have potential or actual contamination.

1.2 PROJECT SCOPE

The investigation includes reviewing readily available Site information. The Site Reassessment (SR) included field screening of volatiles in groundwater wells, measurement of groundwater elevations in wells, photo documentation of Site features, and sampling activities at the Site and off-site. Soil, sediment, waste sediment, surface water, and groundwater samples were submitted for laboratory analysis to verify the nature and extent of potential contamination and COCs.

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2.0 SITE BACKGROUND

2.1 LOCATION

The Site is located within the boundaries of Township 30N, Range 20W, Section 3 at 48.3931351074135 latitude and -114.134158794466 longitude (Figure 1). The Site is approximately 2.0 miles northeast from the population center of Columbia Falls, Flathead County, Montana, at 2000 Aluminum Drive. The closest residences are approximately 1 mile north, southeast, and west of the Site. According to the 2010 Census (American Fact Finder, www.factfinder2.census.gov), the total population of Flathead County is 90,928 and the total population of Columbia Falls is 1,150. The elevation at the Site is approximately 3,100 feet above mean sea level (amsl). Topography at the Site is generally flat with a southern slope at approximately 3° to 4° with the area north of the Site slightly steeper at approximately 5° to 6° (Ecology and Environment, Inc., 1988a).

From Columbia Falls, Montana, access to the Site is via 9th St W (US 2) to Nucleus Ave (County Road [CR] 486). Follow Nucleus Ave (County Road 486) north for 0.6 miles then turn east on Railroad St E (CR 486) and follow for 0.6 miles to N Fork Rd (CR 486). Follow 0.8 miles to Aluminum Drive and go east for 1 mile to the CFAC plant.

2.2 SITE DESCRIPTION

The total area of the property owned by CFAC is approximately 3,196 acres (Figure 1). For the purposes of this investigation Site is defined as the historical and observed operations area and is approximately 953 acres (Figure 1). The Site is bordered to the north by Cedar Creek Reservoir, to the east by Teakettle Mountain, to the south by the Flathead River, and to the west by Cedar Creek. Current Site use is primarily for minimal plant maintenance activities, wildlife corridors, and local specially permitted hunting limited to the west and north sides of the Site in the fall. Access to the Site is available via Aluminum Drive and through private land from the north. The closest residence is adjacent to the western CFAC property boundary and is approximately 0.92 miles from the plant.

2.1 PHYSICAL CHARACTERISTICS

2.1.1 Regional Climate

There is a meteorological data station (#248902) in Whitefish, Montana located approximately 10 miles west of the Site and monthly climate data is available from November 1, 1939 through March 29, 2013. Average winter temperatures in the Whitefish area range from 16.0 °F to 54.6 °F and average summer temperatures range from 30.0 °F to 81.5 °F. The average annual high temperature is 54.7 °F. Average annual precipitation is 21.75 inches with most occurring during the spring and winter seasons. Prevailing winds in the area are generally to the south and south-southeast. (Western Regional Climate Center, 2013)

W0004.1A.00115

2.1.2 Geologic and Hydrologic Setting

2.1.3 Geologic Setting

According to the Draft Analytical Results Report by Ecology and Environment, Inc. (November 11, 1988),

“the Site is located approximately 1/2 mile northwest of Badrock Canyon. Teakettle Mountain, the principle geologic feature in the area located adjacent to and east of the Site is comprised of primarily Precambrian undifferentiated sedimentary strata of the Ravalli Group superimposed by the Piegan Group dolomites (Hydrometrics, 1985).

The Quaternary stratigraphy near the Site is locally complicated due to the heterogeneous nature of glacial and alluvial deposits. Based on well logs from the Site, bedrock is estimated to be variable from 145 feet to 300 feet.

Alden (1953) suggests the area near Columbia Falls is underlain by primarily glacial till deposited by the Cordilleran Ice Sheet. Konizeski (1968) further suggests that the substratum near Columbia Falls is characterized by "ice-contact, drumlin-forming clay and boulder till; locally overlain by glaciolacustrine deposits". The glaciolacustrine deposits mentioned by Konizeski (1968) are those derived by Glacial Lake Missoula. Based on local well logs, the glacial drift, glacial till and glaciolacustrine deposits are inferred to be interfingered at and near the Site. Pleistocene glaciofluvial outwash and recent alluvial deposits overlying the glacial stratigraphy are found to exist near the southern border of the Site. Additional alluvial deposits can be found in the Cedar Creek floodplain. Hydrometrics (1985) suggest that "the Flathead River and Cedar Creek flow primarily through Recent alluvium consisting dominantly of silt and sands comprising the modern floodplains".

2.1.4 Hydrologic Setting

The Site is located north of the Flathead River within the Flathead River-Columbia Falls watershed. The Site is located downslope and to the west of Teakettle Mountain's South peak between approximately 3,015 feet and 3,200 feet amsl and is situated between Cedar Creek to the west, Cedar Creek Reservoir to the north, and Cedar Creek Reservoir Overflow Drainage to the east. "Information obtained from the city of Columbia Falls indicate that the Montana Soil and Conservation Service constructed a reservoir on Cedar Creek [Figure 1] approximately 2 miles north of the Site as a means of flood control and potable water storage in the early 1960's" (Ecology and Environment, Inc., 1988). Water from the Site drains west approximately 1/4-1/2 mile to Cedar Creek. Cedar Creek flows from the northern portion of the site approximately 2.7 miles southwest towards the City of Columbia Falls where it dissipates. Surface water on the eastern side of the site from the East and Sanitary Landfills flows west to the Cedar Creek Reservoir Overflow Drainage. The drainage also flows from the northern portion of the site approximately 1.8 miles southeast toward the Flathead River where it dissipates. The Cedar Creek Reservoir Overflow Drainage flows intermittently in the spring and regulates flow for

W0004.1A.00115

Cedar Creek and the Cedar Creek Reservoir. Water also flows south approximately ¼ mile into the Flathead River and continues to the surface water pathway 15-mile downstream limit. According to the Draft Analytical Results Report by Ecology and Environment, Inc. (November 11, 1988),

“The north and middle forks of the Flathead River originate in Glacier National Park and flow south from Glacier National Park where they meet the South Fork at the mouth of Badrock Canyon. The Flathead River flows west through Badrock Canyon to Columbia Falls where it's course is southerly to Flathead Lake.

The Site is typical of the northern Rocky Mountains of northwestern Montana and is moist with rivers and streams. As a result, water was encountered in the Cedar Creek streambed, North Pond (east), and Flathead River during the 2013 field investigation. Water was observed during the preliminary Site evaluation in June 2013 in the Cedar Creek Reservoir overflow drainage ditch on the east side of the Site.

The Site also contains surface water bodies that were sampled under this investigation. Five percolation ponds are currently used as receptacles for cooling and waste water from the plant. Surface water quality parameters were recorded for all water samples collected under this investigation. A discussion of surface water quality parameters is presented in Section 3.3.2.

2.1.5 Hydrogeologic Setting

2.1.5.1 Stratigraphy

In their November 1988 report, Ecology and Environment, Inc. reported that

“the Flathead Valley has undergone several distinct erosional, depositional and geologic events. Ground water occurrence and distribution in the Flathead Valley is largely dictated by Precambrian bedrock, Pleistocene Glacial Deposits and recent alluvially deposited materials. The nature of glacially and alluvially deposited materials in the Flathead Valley results in a very complex hydrogeologic setting.

The Pleistocene glacial deposits mantle most if not all of the Flathead Valley. The glacially deposited material influences greatly the occurrence and distribution of ground water in the valley. Due to the complex depositional nature of the glacial, peri-glacial, glaciofluvial and glaciolacustrine deposits in the valley, ascertaining exact hydrogeologic relationships of aquifer systems is difficult. Konizeski, et.al. (1968) identified five major aquifer systems within the Flathead Valley. For continuity, the terminology of Konizeski, et.al. (1968) will be retained for describing the regional hydrogeologic setting; however, this scheme may not strictly apply when evaluating the aquifer of concern. The five aquifer systems of Konizeski, listed in descending order are as follows:

- 1) Recent floodplain aquifer - includes alluvium of the Flathead River and major tributaries.

W0004.1A.00115

- 2) Pleistocene Perched Aquifers - includes the glaciolacustrine and glacial drift deposits of the east valley terrace. This aquifer system consists of at least two and possibly more individual aquifers.
- 3) Pleistocene Shallow Artesian Aquifer - A locally important outwash of sand and gravel that underlies glacial drift in areas of the valley.
- 4) Pleistocene Deep Artesian Aquifer - includes interfingering sand and gravel beds beneath the Pleistocene Shallow Artesian Aquifer or glacial drift.
- 5) Precambrian Bedrock Aquifer - All belt series sedimentary rocks bordering and underlying the valley.

Hydrometrics (1985) installed a series of piezometers in order to gain a better understanding of onsite subsurface depositional relationships. The piezometers "show a succession of till and small patches of glaciolacustrine clays, capped by from one foot to greater than twelve feet of imbricated glaciofluvial and alluvial sands, gravels and cobbles. This capping unit appears to be more extensive and thicker north and west of the plant complex than it is to the northeast." The retrieval of cutting samples during drilling confirmed the heterogeneous nature of the substratum. Drillers logs obtained from the MDNRC provide more evidence of the complex heterogeneous depositional modes. The logs indicate that from 70 to more than 300 feet of interbedded glacial, glaciofluvial and glaciolacustrine sediments underlie the Site. Extrapolation of the logs also indicates that these glacially related units are vertically and laterally discontinuous."

Drillers logs obtained for this investigation for both onsite and residential wells where samples were collected are provided in Appendix A. Not all well logs were reasonably ascertainable for all wells sampled.

2.1.5.2 Groundwater Depth and Flow Direction

According to the Draft Analytical Results Report by Ecology and Environment, Inc. (November 11, 1988),

"A buried glacial outwash channel, consisting of cobbles and gravels emanating from Badrock canyon and evident along this southern border of the Site, is host to a highly transmissive water bearing zone at depths greater than 100 feet. The depth to ground water is variable at the site. Water table depths of 15 feet are evident in CFAC monitoring wells located approximately 100 feet north of the Flathead River. Additionally, a ground water level of 100 feet was recorded by Hydrometrics (1985) in a test well located between the East Landfill (spent potliner landfill) and the Wet Scrubber Sludge Pond (Figure [2]). Both water level measurements were taken in August, 1985. Extrapolation of water level measurements (Hydrometrics, 1985) indicates a southwest ground water flow direction."

W0004.1A.00115

As part of the objectives of the 1988 investigation conducted by Ecology and Environment, Inc. to assess the local groundwater flow direction, four on-site wells were surveyed and vertical elevations established. The surveyed wells included CF-MW-1, CF-MW-2, TW-2, and TW-8 and were utilized to provide the best hydrogeologic coverage of the Site. The elevations at each well were measured at a reference mark on the well using a Leitz Sokkisha C3A Automatic Level. A United States Department of the Interior Geologic Survey (USGS) benchmark relating true elevation in the area was unavailable, thus a marked elevation of 3111.41 feet was taken from the CFAC sewage treatment facility located south of the plant buildings. From this reference point, the above specified wells were surveyed by closed loop traverse for potentiometric contouring purposes. (Ecology and Environment, Inc., 1988)

Based on water level data, elevation data, field observations and water quality data collected by Ecology and Environment, Inc. in 1988, a potentiometric surface map of the shallow alluvial aquifer at the plant was prepared and infers groundwater flow, due to a lack of data points in certain areas, as generally flowing southwest toward the river. Correlation of this potentiometric contour map is very consistent to the potentiometric contour map prepared by Hydrometrics (1985). (Ecology and Environment, Inc., 1988)

Based on groundwater level measurements conducted by START during the current investigation, depth to groundwater varies across the Site with a depth to water of approximately 14 feet below ground surface (bgs) as evident in CFAC monitoring well W1-PW7, located approximately 100 feet north of the Flathead River, to approximately 126 feet bgs in test well TW10 located between the South Leachate Pond and the Wet Scrubber Sludge Pond (Figure 2). Both water level measurements were taken during the field sampling activities on September 24, 2013. Extrapolation of water level measurements collected during this investigation indicates a southwest groundwater flow direction across the northern two thirds of the Site and a south-southeast groundwater flow direction across the bottom southeast corner of the Site adjacent to the Flathead River. Results for groundwater flow across the Site as indicated in the potentiometric contour map (Figure 3) are similar to those obtained during the previous investigation from Hydrometrics (1985) and Ecology & Environment, Inc. (1988).

In their November 1988 report, Ecology and Environment, Inc. reported that

“An aquifer test conducted by Hydrometrics indicated that ground water yields at the Site are highly variable ranging from over 1500 gallons per minute (gpm) to only a few gpm. Wells yielding greater quantities of ground water are those located closer to the Flathead River. This large variability in ground water yield is due to the heterogeneous nature of glacial deposits underlying the Site. Commensurate to ground water yield, Hydrometrics also established transmissivities ranging from several thousand gallons per day per foot (gallons per day [gpd]/foot [ft]) to less than 100 gpd/ft.

Recharge to ground water beneath the Site occurs by precipitation infiltration and infiltration of ephemeral streams on the west flank of Teakettle Mountain, and by surface water from Cedar Creek. Groundwater discharge is principally to the Flathead River. Groundwater discharge also occurs by withdrawal from wells in the area.”

W0004.1A.00115

2.1.6 Vegetation and Wildlife

Vegetation at the Site consists of coniferous forest and grasses characteristic of the Montana montane environment. Pines, spruces, firs, grasses, and forbs are common at the Site. Ponderosa pine, Douglas fir, western larch, aspen, cottonwood, and maple trees, willow and common snowberry were identified during the 2013 field investigation. No evidence of stressed vegetation was observed during any visits to the Site. Wildlife species observed during the 2013 field investigation included white-tail deer.

2.1.6.1 Threatened and Endangered Species

Information regarding threatened, endangered, or sensitive species is available for Flathead County but not currently available on a site-specific basis. A search of the U.S. Fish & Wildlife Service (USFWS) Environmental Conservation Online System (ECOS), available online at <http://www.ecos.fws.gov> and the Montana Fish, Wildlife & Parks (FWP) Threatened Species list, available online at <http://fwp.mt.gov>, indicates 12 different species (two fish and seven mammals, one insect, one flowering plant, and one conifer) are present in Flathead County that are considered federal or state listed threatened, endangered, or sensitive species (USFWS, 2013; MSP, 2013). The following species are associated with the study area:

- Bull Trout (*Salvelinus confluentus*);
- Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*);
- Meltwater Lednian stonefly (*Lednia tumana*);
- Spalding's Catchfly (*Silene spaldingii*);
- Grizzly Bear (*Ursus arctos horribilis*);
- Gray Wolf (*Canis lupus*);
- Canada Lynx (*Lynx canadensis*);
- Black-footed Ferret (*Mustela nigripes*);
- Northern Bog Lemming (*Synaptomys borealis*);
- North American wolverine (*Gulo gulo luscus*);
- Fisher (*Martes pennant*); and
- Whitebark pine (*Pinus albicaulis*).

A site-specific biological assessment has not been performed; however, according to a query of the FWP Montana Fisheries Information System database (MFISH), fish surveys conducted in 2008 in Taylor Spring Creek located approximately 1.4 miles southwest of the site, but within the CFAC property boundary, identified the presence of the Westslope Cutthroat Trout (MSP, 2014). The ECOS and MFISH identified habitat for the Bull Trout (federally threatened) and Westslope Cutthroat Trout (federally sensitive) in the Flathead River and the Westslope Cutthroat Trout in Cedar Creek (MSP, 2014). FWP confirmed the presence of the Westslope Cutthroat Trout in Cedar Creek (Deleray, 2014b). No connection of Cedar Creek to the Flathead River was able to be confirmed during this investigation. Fish surveys conducted by FWP in

W0004.1A.00115

2008 have confirmed the presence of both species in the Flathead River adjacent to the Site (MSP, 2014). None of the aforementioned species were observed to be present during the current site investigation activities. Likewise, the above list is not to be considered a comprehensive list of possible threatened and endangered species that may be present on the Site.

2.2 OPERATIONAL HISTORY

The Anaconda Copper Mining Company built the Anaconda Aluminum Reduction Facility and began production in 1955. The Atlantic Richfield Company (ARCO) purchased the plant in 1978 and operated it until 1985 when it was sold to the Montana Aluminum Investor's Corporation and began operations under CFAC. In 1999, Glencore acquired the company and operated until 2009 when production was curtailed due to poor economic conditions for aluminum production.

The plant is a Vertical Stud Soderberg aluminum reduction facility that uses the Hall Heroult process of producing aluminum in carbon-lined "pots" heated to 960 degrees Celsius (°C). Aluminum oxide is dissolved in a molten cryolite bath and aluminum oxide is reduced to aluminum metal by electrons from direct current through the pot. The molten aluminum is then tapped from the pot and cast into ingots. This process uses 350 megawatts, and 600 pots at 100% production. There are currently 451 pots in place; however the facility has not operated since October 31, 2009.

The CFAC was identified on USGS 7.5 minute series revised 1994 Columbia Falls North quadrangle topographical map. The topographical map indicates the plant, substation, both North Ponds, and the Wet Scrubber Sludge Pond are present. The plant and features shown on the USGS 1994 quadrangle were confirmed during the site visit on June 3, 2013, and the September-October 2013 sampling event conducted by START. Photographs of the plant and observed features are presented in Appendix B.

2.3 CURRENT SITE CONDITIONS

Aluminum smelting operations are not currently active on-site; however, the plant features identified and included in this investigation consist of numerous buildings and industrial operating facilities such as offices, warehouses, mechanical shops, laboratory, washhouse, paste plant, coal tar pitch tanks, pump houses, and the main pot line facility. Features on the Site include percolation ponds, leachate ponds, sludge ponds, sewage treatment ponds, cathode soaking pits, closed and operational landfills (Figure 2). Current Site conditions are based on observations made during the September 23, 2013 through October 1, 2013 sampling event. Photographs of observed Site features are presented in Appendix B and geographical coordinates of features observed during the current investigation are in Appendix C. Site features (Figure 2) observed during the 2013 sampling event are described in Table 1 below.

W0004.1A.00115

Table 1 Observed Site Features

Feature (References)	Description
East Landfill (Columbia Fall Aluminum Company (CFAC) Storm Water Pollution Prevention Plan (SWPPP), CFAC, October 1994.)	The Spent Potliner Landfill, also known as the East Landfill, operated from approximately 1980-1990 and is a clay-lined landfill used to dispose of spent potliners prior to their declaration as a hazardous waste. The landfill was capped with a synthetic cap and revegetated in 1990. MT DEQ was aware of the landfill closure plan (October 12, 1989 letter from John Arrigo, MT DEQ Water Quality Bureau, to Don Ryan, CFAC). This area was observed to be closed and covered with grass during the field sampling activities.
West Landfill (CFAC SWPPP, CFAC, October 1994. MPDES Permit January, 1999. CFAC PowerPoint Presentation for EPA, June 3, 2013. Draft Analytical Results Report, Columbia Falls Aluminum Company, Columbia Falls, Montana, EPA, November 11, 1988.)	CFAC operated an unlined solid waste landfill, also known as the West Landfill, from 1955-1981 for which they disposed of general garbage including, paper, scrap from the shops, strapping, steel scrap and scrap wood, and spent potliner (1955-1970). Spent potliner wasn't listed by the U.S. EPA as hazardous waste until 1991. As a result, groundwater monitoring around the landfill had detected elevated concentrations of cyanide, a byproduct of the carbon product pot life. The landfill was capped with a clay cap in approximately 1992 / synthetic cap in 1994 (EPA Presentation) as a special permit condition under the MPDES Permit No. MT0030066. Solvents and hazardous wastes are known to have been buried on-site in the closed landfills (West, Center and Sanitary). This area was observed to be closed and covered with grass during the field sampling activities.
Wet Scrubber Sludge Pond Landfill (CFAC SWPPP, CFAC, October, 1994. MPDES Permit Renewal and Mixing Zone Application, CFAC, July 31, 1998. Identified by Steve Wright, CFAC, during June 2013 site visit.)	Wet Scrubber Sludge Pond Landfill was closed in approximately 1980 and contained sludge waste generated from the Wet Scrubber System and for a period from approximately 1994-1998 contained spent potliner material. The landfill was recontoured, covered with native soil and revegetated with native grasses. This area was observed to be closed and covered with grass during the field sampling activities.
Center Landfill (MPDES Permit Renewal and Mixing Zone Application, CFAC, July 31, 1998. CFAC PowerPoint Presentation for EPA, June 3, 2013. Draft Analytical Results Report, Columbia Falls Aluminum Company, Columbia Falls, Montana, EPA, November 11, 1988.)	The Center Landfill, also known as the Carbon Pile, is an unlined landfill operated from approximately 1970-1980. Solvents and hazardous wastes are known to have been buried on-site in the closed landfills (West, Center and Sanitary). This area was observed to be closed and covered with grass during the field sampling activities.

W0004.1A.00115

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Feature (References)	Description
Sanitary Landfill (Draft Analytical Results Report, Columbia Falls Aluminum Company, Columbia Falls, Montana, EPA, November 11, 1988. CFAC PowerPoint Presentation for EPA, June 3, 2013.)	The Sanitary Landfill is a clay-lined historic landfill used for plant garbage. The landfill was covered with soil and revegetated. Years of operation unknown. Solvents and hazardous wastes are known to have been buried on-site in the closed landfill (West, Center and Sanitary). This area was observed to be closed and covered with grass during the field sampling activities.
Asbestos Landfill (Location identified by Steve Wright, CFAC, during June 2013 site visit.)	Based on a review of aerial photography the Asbestos Landfill began operation in approximately the early 2000's; date last used is unknown. This area was observed to be closed and covered with grass during the field sampling activities.
Industrial Landfill (Location identified by Steve Wright, CFAC, during June 2013 site visit. CFAC PowerPoint Presentation for EPA, June 3, 2013.)	The Industrial Landfill is an active landfill that receives non-hazardous waste and debris. This area was observed to be active and disturbed. The area was covered with gravelly soil during the field sampling activities.
North and South Leachate Ponds (CFACF SWPPP, CFAC, October 1994. Letter from Donald F. Ryan, Laboratory Manager at CFAC, to MT DEQ dated January 5, 1990. Aerial Photographic Analysis of Waste Study Sites, Montana, EPA Region 8, November, 1984.)	Two hypalon-lined leachate ponds were constructed on opposite ends of the East Landfill in 1980, one on the north side of the landfill (North Leachate Pond) and one on the south side of the landfill (South leachate Pond). The ponds were used to collect runoff water from the East Landfill containing the spent potliner material and aerated during the summer months to reduce water volume and utilize ultraviolet light to break down the cyanide. According to a letter from Donald F. Ryan, Laboratory Manager at CFAC, to MT DEQ dated January 5, 1990, approximately 150,000 gallons of leachate water containing fluoride and approximately 3 mg/L of cyanide was drained from the South Leachate Pond into the Wet Scrubber Sludge Pond Landfill. This transfer of leachate was approved by MT DEQ (October 12, 1989 letter from John Arrigo, MT DEQ Water Quality Bureau, to Don Ryan, CFAC). The South leachate Pond was dried, capped, and subsequently closed in 1993. An underground pipe leads from the North Leachate Pond to the Wet Scrubber Sludge Pond. The North Leachate Pond held cyanide-free water containing fluoride and was subsequently drained into the Wet Scrubber Sludge Pond Landfill. The North Leachate Pond was capped and then closed in 1994. These areas were observed to be closed and covered with grass during the field sampling activities.

W0004.1A.00115

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Feature (References)	Description
North Percolation Ponds (CFAC SWPPP, CFAC, October 1994 and MPDES Permit Renewal and Mixing Zone Application, CFAC, July 31, 1998. MPDES Permit January, 1999. Draft Analytical Results Report, Columbia Falls Aluminum Company, Columbia Falls, Montana, EPA, November 11, 1988. MT DEQ Columbia Falls Aluminum Plant SAP Comments, August 22, 2013.)	The North Percolation Ponds (smaller eastern pond receives direct discharge, larger western pond is overflow) historically received wastewaters from the Paste Plant Briquette Quench system, Paste Plant Ball Mill Bearing Cooling system, Wet Scrubber Blowdown (until approximately 1999), Air Compressor Cooling, Air Compressor Condensate Blowdown, Masonry Shop, and Battery Shop. Prior to 1978 the waste effluent from the soaking of the carbon cathodes was piped to the North Percolation Pond, also known as the Boiler Blowdown Pond (smaller pond). In addition to the aforementioned, the ponds currently receive garage waste water, steam cleaning and pin crane sumps waters, lab boiler blowdown water, equipment non-contact cooling water, and process area stormwater. Both ponds contained dark gray/black process material and were sparsely vegetated with grasses, shrubs, and trees. No water was present in the western pond during the field sampling activities. The smaller eastern pond contained water of an unknown depth.
West Percolation Pond (MT DEQ Columbia Falls Aluminum Plant SAP Comments, August 22, 2013.)	The West Percolation Pond receives wastewater from the boiler blowdown (Fabrication Shop, Warehouse, and Change House) and stormwater from the parking lots. The pond was not visited during the field sampling activities.
South Percolation Ponds (CFAC SWPPP, CFAC, October 1994 and MPDES Permit Renewal and Mixing Zone Application, CFAC, July 31, 1998. MPDES Permit January, 1999. MT DEQ Columbia Falls Aluminum Plant SAP Comments, August 22, 2013.)	The South Percolation Ponds receive wastewaters from the Rectifier Oil Separator Sump, Facility Production Area stormwater, non-contact equipment cooling water, Sewage Treatment Plant, Restrooms and Change House sinks, Laboratory Sinks, laboratory non-contact cooling water, laboratory non-solvent waste water, plant wide lavatories and sinks, Rectifier non-contact cooling water, casting mold cleaning water, casting mold steam cleaning, contact cooling water from direct chill casting of aluminum ingots, and Fabrication Shop Steam Cleaning Bay. The south percolation ponds were predominantly dry with minimal amounts of water in the ponds during the field sampling event. Both were vegetated with grasses, shrubs, and trees.
Storage Tanks (CFAC SWPPP, CFAC, October, 1994. MT DEQ Columbia Falls Aluminum Plant SAP Comments, August 22, 2013. Email correspondence from Dalynn Townsend at MT DEQ to Robert Parker at EPA, September 13, 2013.)	There are several underground and above ground storage tanks located throughout the property that historically housed diesel, gasoline, and waste oil. One 3500 gallon underground storage tank (UST) is located north of the potlines, one 500 gallon aboveground storage tank (AST) is located at the Mechanical Shops forge, one 2000 gallon AST is located behind the Paste Plant, and one 500 gallon AST is located at the Compressor House, all contained diesel fuel. One UST of unknown size is located north of the potlines and contained unleaded gasoline. Two 1000 gallon ASTs are located in the Garage Oil Shed with one historically containing hydraulic oil and one historically containing motor oil. In addition, there are nine USTs that are closed/permanently out of use (Tank IDs#1-5, 7, 8, 11, and 12) that housed diesel, gasoline, and waste oil and ranged in size from 50 to 20,000 gallons. Currently, there are three USTs used onsite. One 5,000 gallon tank (Tank ID#10) that houses gasoline, and one 3,000 (Tank ID#9) and one 12,000 (Tank ID#6) gallon tank that house diesel. No tanks were observed during the field activities.

W0004.1A.00115

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Feature (References)	Description
Industrial By-products Area (Aerial Photographic Analysis of Waste Study Sites, Montana, EPA Region 8, November, 1984. Review of aerial photographs taken during various years from 1956 to 2012.)	The Industrial by-products area and numerous waste piles have been identified in various locations throughout the Site. This area was observed during the field activities to be disturbed with some grass cover.
Cathode Soaking Pits (Review of historic data and HRS evaluation. CFAC PowerPoint Presentation for EPA, June 3, 2013. Interview with Brian Doyle, former CFAC employee, June 4, 2013.)	Carbon cathode soaking pits contained water and ammonia to expedite the carbon removal process. The pits were not observed during the sampling activities.

W0004.1A.00115

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The following previously unidentified site feature was observed during the 2013 sampling event (Figure 2):

- Asbestos Landfill – The asbestos landfill was not documented on the USGS topographical map, but is located in the area depicted on the aerial photographs of Site (Figure 2) on the east side of the Site. The asbestos landfill area is approximately 0.4 acres in size. (Photograph No. 48, Appendix B).

2.4 PREVIOUS INVESTIGATIONS/REGULATORY INVOLVEMENT

The Site is an aluminum smelting facility located adjacent to the Flathead River in Columbia Falls, Montana (Figure 1). A Preliminary Assessment (PA) performed on March 5, 1984 by Montana Department of Health and Sciences (MDHES) concluded that hazardous wastes generated onsite were spent halogenated and non-halogenated solvents. Solid wastes included spent potliners, basement sweepings, and air pollution control dusts. A SI by Ecology and Environment, Inc. was conducted in 1988 at the request of the EPA. The results of their investigation indicated that high polycyclic aromatic hydrocarbons (PAHs) occurred primarily in soils and sediments and a release to groundwater and surface water of cyanide had occurred, both of which were attributable to plant processes. No release of organic compounds to surface water or groundwater, including the Columbia Falls backup municipal supply well, from the Site had occurred. Following this investigation, the EPA classified the site as No Further Remedial Action Planned (NFRAP).

Remedial activities that have occurred on the Site include addressing a transformer fire in the rectifier yard that occurred on September 10, 1991. The transformer held approximately 10,000 gallons of dielectric fluid that contain approximately 207 parts per million (ppm) polychlorinated biphenyls (PCBs). Approximately 4,000 gallons spilled into the containment basin and the explosion resulted in the contamination of an approximate 4,000 to 5,000 square-foot area. According to the Remedial Activities Report by Olympus Environmental, Inc. (April 14, 1992) the spill area soils and structures were remediated to acceptable levels and no further cleanup was recommended by the EPA.

In 1994 two capacitors in the West Rectifier Yard Capacitor Bank exploded contaminating steel holding frames and soil with 3 to 4 gallons of pure PCBs. According to CFAC's October, 1994 Storm Water Pollution Prevention Plan (SWPPP) the surrounding capacitors, framing, and soils were removed and disposed of in a certified Toxic Substances Control Act (TSCA) landfill, and the area cleared for operational use.

In February 1998, The State of Montana's Permitting and Compliance Division of the Air & Water Management Bureau requested that CFAC remove all of the spent potliner material (EPA hazardous waste number K088) present in the Wet Scrubber Sludge Pond Landfill due to improper disposal of a hazardous waste. Post removal, on July 28, 1998 CFAC sampled the pot diggings material from the Wet Scrubber Sludge Pond Landfill to determine if carbon in the Wet Scrubber Sludge Pond Landfill had been adequately removed. Results of the sampling indicated that cyanide was detected in all of the pot diggings material samples collected (highest concentration 2.1 ppm) and half of the soil samples collected from under the waste pile. The EPA Region III Residential Risk-Based Criteria was 1600 ppm and thus, in October 1998, the

W0004.1A.00115

State declared no further clean-up action required for the pot diggings material or soil under the pile.

CFAC conducted sampling on September 25, 2001 during suspended plant operations in response to inquiries by the Montana Department of Environmental Quality Air and Waste Management Bureau as to the determination if waste in accumulation is hazardous waste. Materials sampled were anode briquettes, cryolite bath, coal tar pitch, anode dust control bags, potlines sweepings bags, treatment of aluminum crucibles cartridges, paste plant dry coke scrubber bags, and primary gas collection system bags. The analytical results indicated that none of the sampled materials were classified as hazardous waste (Wright, 2001).

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3.0 CURRENT INVESTIGATION

The current investigation included one round of groundwater elevation measurements of onsite wells and environmental sample collection to provide information to 1) document if a contaminant release has occurred, 2) evaluate through the HRS scoring if the Site is eligible for the NPL as a result of historical aluminum processing activities at the Site, 3) assess the relative risk to human health and the environment, and 4) determine the need for additional investigation or action.

Field sampling activities were conducted from September 23, 2013 through October 1, 2013. START personnel conducted a reconnaissance of each onsite groundwater well and of the Site features and took photographs documenting general conditions. General site features and/or conditions including observations regarding areas of stressed vegetation, debris, activity remnants, or any access issues (e.g., road/trail condition and width, etc.) were noted at each feature and sampling location in the field log books.

Feature locations were documented using a handheld global positioning system (GPS) unit and recorded in the field logbook. GPS data were collected using Trimble Pro-XRT with Omni Star service backpack GPS units (vertical accuracy of 15 to 30 centimeters and horizontal accuracy of 10 to 15 centimeters). All GPS data was recorded in UTM NAD83, Zone 11 N datum. Site sketches were drawn in the logbook, as appropriate.

Photographs of field activities and site features are included in the Photograph Log in Appendix B and geographic locations of site features are presented in Appendix C. Media evaluated at the Site include soil, sediment, waste sediment, surface water, and groundwater. Table 2 outlines the sample quantity for each media collected during the September-October 2013 sampling efforts.

3.1 SAMPLE LOCATIONS AND METHODOLOGIES

Environmental samples were collected in soil, sediment, waste sediment, surface water, and groundwater locations in areas intended to characterize background and Site conditions. A map of background sample locations is included as Figure 4. GPS coordinates and a description of each sample location are presented in Table C1 of Appendix C.

In general, the planned sample locations were biased towards areas where historic plant operation activities occurred (e.g., the landfills, waste ponds), and areas that appeared more likely to have an impact due to the nature or size of the feature (e.g., potential land disturbance area or streambed). Any variations in sample collection procedures identified in the project SAP are outlined in Section 3.4. The samples planned versus actually collected are listed in Table 2. A description of the sample collection methodologies for each feature and matrix is provided in the following sections.

W0004.1A.00115

Table 2 Columbia Falls Aluminum Company Site Collected Sample Quantities

Matrix	Location	Location Type	Planned	Actual ¹	VOCs	SVOCs	PAHs ²	Pesticides	PCBs	Total TAL Metals	Dissolved TAL Metals	Fluoride	Nitrate/Nitrite as N
					Submitted for Laboratory Analysis								
Ground Water	CF-GW-MW-01	Background	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-02	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-03	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-04	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-05	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-06	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-07	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-08	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-09	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-10	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-11	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-12	Residential	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-13	Residential	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-14	Residential	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-15	Residential	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-16	Site Duplicate	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-MW-17	Site Duplicate	1	0	0	0	0	0	0	0	0	0	0
	CF-GW-MW-18	Site Duplicate	1	1	1	1	1	1	1	1	1	1	1
	CF-GW-OP-02	Residential	0	1	1	1	1	1	1	1	1	1	1
Surface Water	CF-SW-01	Background	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-02	Background	1	0	0	0	0	0	0	0	0	0	0

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Matrix	Location	Location Type	Planned	Actual ¹	VOCs	SVOCs	PAHs ²	Pesticides	PCBs	Total TAL Metals	Dissolved TAL Metals	Fluoride	Nitrate/Nitrite as N
					Submitted for Laboratory Analysis								
Surface Water	CF-SW-03	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-04	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SW-05	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-06	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-07	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-08	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-09	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-10	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SW-11	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SW-12	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SW-13	Background	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-14	Background	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-15	Background	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-16	Background	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-17	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SW-18	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SW-19	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-20	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-21	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-22	Site	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-23	Site Duplicate	1	1	1	1	1	1	1	1	1	1	1
	CF-SW-24	Site Duplicate	1	1	1	1	1	1	1	1	1	1	1

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Matrix	Location	Location Type	Planned	Actual ¹	VOCs	SVOCs	PAHs ²	Pesticides	PCBs	Total TAL Metals	Dissolved TAL Metals	Fluoride	Nitrate/Nitrite as N
					Submitted for Laboratory Analysis								
Surface Water	CF-SW-25	Site Duplicate	1	1	1	1	1	1	1	1	1	1	1
Sediment	CF-SD-01	Background	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-02	Background	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-03	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-04	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-05	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-06	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-07	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-08	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-09	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-10	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SD-11	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SD-12	Site	1	0	0	0	0	0	0	0	0	0	0
	CF-SD-13	Background	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-14	Background	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-15	Background	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-16	Background	1	1	1	1	1	1	1	1	0	1	0
	CF-WS-17	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-WS-18	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-WS-19	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-WS-20	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-WS-21	Site	1	1	1	1	1	1	1	1	0	1	0

W0004.1A.00115

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Matrix	Location	Location Type	Planned	Actual ¹	VOCs	SVOCs	PAHs ²	Pesticides	PCBs	Total TAL Metals	Dissolved TAL Metals	Fluoride	Nitrate/Nitrite as N
					Submitted for Laboratory Analysis								
Sediment	CF-WS-22	Site	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-23	Site Duplicate	1	1	1	1	1	1	1	1	0	1	0
	CF-WS-24	Site Duplicate	1	1	1	1	1	1	1	1	0	1	0
	CF-WS-25	Site Duplicate	1	1	1	1	1	1	1	1	0	1	0
	CF-SD-OP-01	Site	0	1	1	1	1	1	1	1	0	1	0
Soil	CF-SS-01	Background	1	1	1	1	1	1	1	1	0	1	0
	CF-SS-02	Background	1	1	1	1	1	1	1	1	0	1	0
	CF-SS-03	Site	1	1	0	0	0	0	0	0	0	1	0
	CF-SS-04	Site	1	1	0	0	0	0	0	0	0	1	0
	CF-SS-05	Site	1	1	0	0	0	0	0	0	0	1	0
	CF-SS-06	Site	1	1	0	0	0	0	0	0	0	1	0
	CF-SS-07	Site	1	1	0	0	0	0	0	0	0	1	0
	CF-SS-08	Site	1	1	0	0	0	0	0	0	0	1	0
	CF-SS-09	Site Duplicate	1	1	1	1	1	1	1	1	0	1	0
Total Site Assessment Samples			77	68	62	62	62	62	62	62	36	68	36

¹ See Section 3.4 for descriptions for planned versus actual sample collection activities.

² PAHs consist of a subset of analytes from the SVOC list that are analyzed lower detection limits.

PAHs – Polycyclic aromatic hydrocarbons

PCBs – Polychlorinated biphenyls

TAL Metals – EPA’s Target Analyte List

SVOCs – Semi-volatile Organic Compounds

VOCs – Volatile Organic Compounds

W0004.1A.00115

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Samples were identified using a site-specific alpha-numeric identification scheme. As outlined in the SAP, the sample identification system is as follows (WESTON, 2013a):

Example Soil Samples: CF-SS-01, *where*

CF = Columbia Falls Aluminum Company Site

SS = Surface soil

01 = Sample location number 1

Example Opportunity Samples: CF-SD-OP-01, *where*

CF = Columbia Falls Aluminum Company Site

SD = Sediment

OP = Opportunity sample

01 = Sample location number 1

Example Trip Blank Samples: CF-TB-01, *where*

CF = Columbia Falls Aluminum Company Site

TB = Trip blank

01 = Sample number 01

Example Field Blank Samples: CF-FB-01, *where*

CF = Columbia Falls Aluminum Company Site

FB = Field blank

01 = Sample number 01

Example Equipment Blank Samples: CF-EB-01, *where*

CF = Columbia Falls Aluminum Company Site

EB = Equipment blank

01 = Sample number 01

Duplicate samples were identified with unique alpha-numeric identification and noted in the field log book. Field filtered TAL metals samples were denoted in Scribe using the Contract Laboratory Program (CLP) parent identification with a “5” after the alphabetic beginning of the sample name. Example: MH5003. Any variations in sample nomenclature identified in the project SAP are outlined in Section 3.4.

3.2 GROUNDWATER ELEVATIONS

A screening of well headspace and groundwater elevations sweep was completed on September 24, 2013 on onsite monitoring wells prior to sampling to aid in the determination of groundwater flow patterns at the Site (Figure 3). Prior to the collection of groundwater fluid measurements, a screening of the well headspace for VOCs and methane vapors was conducted on a representative subset of wells to determine worker safety using a TVA-1000 photoionization

W0004.1A.00115

detector (PID)/flame ionization detector (FID) and the screening results recorded in the log book. None of the wells screened contained VOCs or methane vapors at concentrations above the 10 ppm threshold for worker safety. Headspace screening procedures followed the SOPs presented in the approved SAP (WESTON, 2013a). Recorded measurements are shown in Table C2, Appendix C.

Groundwater elevations were collected with a Solinst 200-foot oil/water interface meter prior to sample collection. The probe was slowly lowered into each well until the probe reached water and the signal activated. The depth was then recorded from the meter tape. For wells in which oil was encountered on top of the water, a tone signaled the air/oil interface and the depth recorded from the meter tape. The probe was then lowered again until a tone signaled the oil/water interface and the depth recorded. The probe was then lowered to the bottom of each well and the total depth recorded from the meter tape. Groundwater fluid elevation measurement procedures followed the SOPs presented in the approved SAP (WESTON, 2013a). Depth to water at the Site ranged from approximately 14 feet below top of casing (btoc) in production well W1-P7 (CF-GW-MW-11) to 126 feet btoc in monitoring well TW10 (CF-GW-MW-07) and averaged approximately 71 feet btoc. Oil was only encountered in production well W1-P7 (CF-GW-MW-11) from 13.31 feet btoc to 13.99 feet btoc) at thickness of 0.68 feet. However, the oil encountered was food grade oil used to lube the pump and is not considered significant. Recorded measurements are shown in Figure 3 and Table C2, Appendix C.

Decontamination of the meter was conducted by spraying the meter tape with a non-phosphate detergent solution followed by a deionized water rinse in conformance with the SOP presented in the approved SAP (WESTON, 2013a).

3.3 SAMPLE COLLECTION

START conducted sample collection activities of soil, sediment, waste sediment, surface water, and groundwater September 24, 2013 through October 1, 2013 at CFAC (Appendix D). Sample collection activities were conducted in Level D personal protective equipment (PPE) in accordance with the approved project SAP (WESTON, 2013a). Any variations in sample collection activities are outlined in Section 3.4 and documented in the field logbooks in Appendix D.

A total of 18 (including two duplicates) discrete groundwater samples, 18 (including three duplicates) grab surface water samples, 23 discrete sediment and waste sediment (including three duplicates) samples, and 9 (including one duplicate) discrete soil samples were collected as described below (Figure 4 and Appendix D).

All groundwater, surface water, sediment, waste sediment, and soil samples CF-SS-01, CF-SS-02, and CF-SS-09 (duplicate) were submitted to the laboratory for CLP analysis of VOCs, SVOCs, PAHs, pesticides, PCBs, total and dissolved TAL metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc), fluoride, and nitrate/nitrite as N. Soil samples CF-SS-03 through CF-SS-08 were only analyzed for fluoride. All groundwater and surface water samples submitted for analysis of total and dissolved metals were field filtered using a Geotech Geopump peristaltic pump using a 0.45 micron filter and preserved with nitric acid (metals analysis) or sodium hydroxide (cyanide

W0004.1A.00115

analysis). Acid was added incrementally to each sample and the pH measured with pH paper until it reached a $\text{pH} \leq 2$ for metals and $\text{pH} \geq 12$ for cyanide.

3.3.1 Groundwater Sampling

Prior to groundwater sample collection, groundwater was field screened with a Horiba U-50 Series Multi-Parameter water quality meter to determine water quality parameters and results recorded in the field logbook for temperature, conductivity, pH, dissolved oxygen, and oxygen reduction potential. After three well volumes were purged, groundwater was collected from each well into a 5-gallon bucket and the water quality meter probe placed in the bucket and allowed to sit until the readings stabilized. The readings were then recorded in the field logbook. Onsite monitoring wells ranged in pH from 6.69 (CF-GW-MW-01) to 9.98 (CF-GW—MW-03). Residential well pH ranged from 7.23 (CF-GW-MW-13) to 7.47 (CF-GW-MW-14). Groundwater water quality measurement procedures followed the SOPs presented in the approved SAP (WESTON, 2013a). Recorded measurements are shown in Table C1, Appendix C.

Decontamination of the meter was conducted by spraying the meter with a non-phosphate detergent solution followed by a deionized water rinse in conformance with the SOP presented in the approved SAP (WESTON, 2013a).

Groundwater samples were collected from a total of 16 locations (11 onsite monitoring wells [CF-GW-MW-01 through CF-GW-MW11] and 5 residential wells [CF-GW-MW12 through CF-GW-MW-15 and CF-GW-OP-02]) as shown in Figure 4 and Appendix B, photos 3 – 16. Sample locations were chosen adjacent to known contamination (e.g. landfills, ponds) and throughout the Site to assess potential contamination sources and migration of contamination on and offsite. Prior to sample collection activities, three well volume casings were purged from each onsite well (CF-GM-MW-01 through CF-GW-MW11). Collection of onsite groundwater samples was accomplished using the dedicated pumps installed in the wells with the exception of CF-GW-MW-01, CF-GM-MW-03, CF-GM-MW-06, and CF-GM-MW-07. CF-GW-MW-01 did not have a dedicated pump installed in the well and CF-GM-MW-03, CF-GM-MW-06 and CF-GM-MW-07's dedicated pumps were not operational during the sampling event. CF-GW-MW-11 is a production well with a flow rate of approximately 1,000 gpm that was operating prior to sample collection, is in a high-yielding groundwater formation, and had no stagnant water in the well above the screened section present; therefore, purging prior to sample collection was not necessary. Wells that had dedicated pumps were connected to a Coleman Powermate 6250 generator and the pump turned on. The samples were then collected from the sample port or spigot on the well. For the wells that did not have dedicated pumps installed, a Grundfos Redi-Flow 2 submersible pump was used. The pump was lowered into the well until it reached the bottom of the well. The pump was then extracted approximately 2 feet above the total depth to avoid intake of sediments. The pump was connected to a Lincoln Electric Ranger generator, the pump turned on and the samples collected directly from the pump tubing.

Decontamination of the pump and tubing was conducted by submersing the pump and tubing into a bin of tapwater and pumping the rinse water through the pump. This was followed by submersion and pumping with a non-phosphate detergent solution, followed by a rinse with deionized water in conformance with the SOP presented in the approved SAP (Weston, 2013a).

W0004.1A.00115

Residential groundwater samples (CF-GW-MW-10 through CF-GW-MW15 and CF-GW-OP-02) were collected from domestic wells used on a frequent basis which prevents stagnant water in the well column. These samples were collected by purging each well of sufficient volume to evacuate stagnant water contained within the plumbing system between the well and the spigot. The samples were then collected directly from the spigot located near the well head. No residential wells were sampled from within the homes. The exception to this collection method was CF-GW-OP-02. Sample collection at this well was obtained by first purging the three pressure tanks located between the well and the spigot. The spigot for this well was located approximately a few inches off the ground and therefore sample bottles were unable to fit underneath the spigot for sample collection. As a result, samples were collected through a garden hose attached to the spigot.

Both onsite and residential groundwater sampling procedures followed the SOPs presented in the approved SAP (WESTON, 2013a) with the exception of CF-GW-MW-03 for total and dissolved TAL metals and mercury which was not able to be properly preserved in the field due to chemical/sample matrix reaction resulting in significant volume loss. As a result, sample results may be biased low. This deviation from the sampling SOP is discussed further in Section 3.4.

3.3.1.1 Background Groundwater Samples

A single Site background sample (CF-GM-MW-01) and duplicate (CF-GW-MW-18) were collected from the only groundwater monitoring well located north and upgradient of the Site features, but within the Site boundary (Figure 5). Groundwater quality measurements are shown in Table C1, Appendix C.

3.3.1.2 Opportunity Groundwater Samples

During the field investigation one residential groundwater opportunity sample (CF-GW-OP-02) was collected from a community groundwater well (Pump 1 Association) in Aluminum City located approximately 1 mile west-southwest of the plant, Figure 5. The well was installed in 1953 and used to supply groundwater to approximately 20 homes within Aluminum City. Currently, the well is connected to 6 homes and serves 5 of those. Recorded measurements are shown in Table C1, Appendix C.

3.3.2 Surface Water Sampling

Prior to sample collection activities, surface water samples were field screened with a Horiba U-50 Series Multi-Parameter water quality meter to determine water quality parameters and results recorded in the field logbook for temperature, conductivity, pH, dissolved oxygen, and oxygen reduction potential. The water quality meter probe was placed in the water body downstream of or far enough away from the sample collection point so as not to agitate sediments and allowed to sit until the readings stabilized. The readings were then recorded in the field logbook. Onsite surface water ranged in pH from 7.69 (CF-SW-03) to 7.95 (CF-SW-22). Flathead River pH ranged from 7.49 (CF-SW-06) to 8.30 (CF-SW-16). Surface water quality measurement procedures followed the SOPs presented in the approved SAP (WESTON, 2013a). Recorded measurements are shown in Table C1, Appendix C.

W0004.1A.00115

Decontamination of the meter was conducted by spraying the meter with a non-phosphate detergent solution followed by a deionized water rinse in conformance with the SOP presented in the approved SAP (WESTON, 2013a).

Surface water samples were collected from a total of 15 locations (6 onsite surface water and 9 Flathead River) as shown in Figure 6 and Appendix B, photos 17 – 39. Sample collection began at the farthest downstream location and worked upstream. Collection of surface water samples was accomplished by collecting a grab sample directly from the water body using the sample collection container for each analysis. The dissolved samples collected for metals analysis were collected and preserved as described above in Section 3.3 by submersing the pump tubing directly into the water body and pumping the water directly into the sample collection bottle. Surface water sampling procedures followed the SOPs presented in the approved SAP (WESTON, 2013a).

All sampling equipment used for surface water sampling was disposable and/or single use and therefore no decontamination was required as described in the approved SAP (WESTON, 2013a).

3.3.2.1 Background Surface Water Samples

A total of five background samples (CF-SW-01 and CF-SW-13 through CF-SW-16) were collected at locations upgradient and north of the Site in Cedar Creek (CF-SW-01), upstream and east of the Site in the Flathead River (CF-SW-13 through CF-SW-16), and outside the areas of impact (Figure 6). The sample collected from Cedar Creek (CF-SW-01) is intended to assess background conditions of onsite surface water. The samples collected upstream and upgradient of the Site in the Flathead River (CF-SW-13 through CF-SW-16) are intended to assess background conditions of the Flathead River outside of the area of potential impacts from the Site. The samples were collected as described in Section 3.3.2. Recorded measurements are shown in Table C1, Appendix C.

3.3.3 Sediment Sampling

Discrete sediment samples were co-located with the surface water samples and were collected from a total of 20 locations (5 onsite sediment [CF-SD-01 through CF-SD-04 and CF-SD-OP-01], 6 onsite waste sediment [CF-WS-17 through CF-WS-22], and 9 Flathead River [CF-SD-05 through CF-SD-09 and CF-SD-13 through CF-SD-16]) as shown in Figure 6 and Appendix B, photos 17 – 39. Onsite sediment samples were collected from the surface water drainages on the east and west side of the Site and are intended to assess migration of onsite contamination to water ways. Waste sediment samples were collected from historic plant process percolation ponds and are intended to assess contaminant levels of source materials present onsite. Sediment samples collected from the Flathead River are intended to assess migration of contamination offsite to the river. Sample collection began at the farthest downstream location and worked upstream. Collection of sediment samples was accomplished by collecting a discrete sample directly from the sediment using a disposable plastic scoop and placing the sediment into the sample container for each analysis. The collection of sediment for VOC analysis utilized a Terra Core Sampler to obtain an approximate 5 gram sample. The Terra Core was pushed into the

W0004.1A.00115

sediment and the sample placed into a 40 mL glass vial. Sediment sampling procedures followed the SOPs presented in the approved SAP (WESTON, 2013a).

All sampling equipment used for sediment sampling was disposable and/or single use and therefore no decontamination was required as described in the approved SAP (WESTON, 2013a).

3.3.3.1 Background Sediment Samples

A total of six background samples (CF-SD-01, CF-SD-02, and CF-SD-13 through CF-SD-16) were collected at locations upgradient and north of the Site in Cedar Creek (CF-SD-01) and Cedar Creek Reservoir Overflow Drainage (CF-SD-02), upstream and east of the Site in the Flathead River (CF-SD-13 through CF-SD-16), and outside the areas of impact (Figure 6). The samples collected from Cedar Creek (CF-SD-01) and Cedar Creek Reservoir Overflow Drainage (CF-SD-02) are intended to assess background conditions of onsite stream sediment. The samples collected upstream and upgradient of the Site in the Flathead River (CF-SD-13 through CF-SD-16) are intended to assess background conditions of the Flathead River outside of the area of potential impacts from the Site. The samples were collected as described in Section 3.3.3.

3.3.3.2 Opportunity Sediment Samples

Upon reconnaissance of the Site one sediment opportunity sample (CF-SD-OP-01) was collected from the Cedar Creek Reservoir Overflow Drainage approximately 325 feet southeast of the South Leachate Pond (Figure 2) as shown in Figure 6. This sample will serve to assess migration of onsite contamination to sediments in the water way. The sample was collected as described in Section 3.3.3.

3.3.4 Soil Sampling

Discrete surface soil samples were collected from a total of eight locations (6 onsite [CF-SS-01 through CF-SS-03 and CF-SS-05 through CF-SS-07] and 2 offsite [CF-SS-04 and CF-SS-08]) as shown in Figure 7 and Appendix B, photos 40 – 47. Surface soil samples were collected from locations across the Site and south of the site across the Flathead River. Surface soils samples CF-SS-01 and CFSS-02 are background samples and are intended to assess background conditions of onsite soil. Soil samples CF-SS-03 through CF-SS-08 are intended to assess aerial deposition of fluoride to surface soil. Collection of surface soil samples was accomplished by collecting a discrete grab sample directly from the soil using a disposable plastic scoop and placing the soil into the sample container for each analysis. The collection of surface soil for VOC analysis utilized a Terra Core Sampler to obtain an approximate 5 gram sample. The Terra Core was pushed into the soil and the sample placed into a 40 mL glass vial. Soil sampling procedures followed the SOPs presented in the approved SAP (WESTON, 2013a).

All sampling equipment used for soil sampling was disposable and/or single use and therefore no decontamination was required as described in the approved SAP (Weston, 2013a).

W0004.1A.00115

3.3.4.1 Background Soil Samples

Two background soil samples (CF-SS-01 and CF-SS-02) were collected at locations upgradient and north of the Site, west of Cedar Creek (CF-SS-01), west of the Cedar Creek Reservoir Overflow Drainage (CF-SS-02), and outside the areas of impact (Figure 7). The samples are intended to assess background conditions of onsite soil. The samples were collected as described in Section 3.3.4. Recorded measurements are shown in Table C1, Appendix C.

3.4 DEVIATIONS FROM THE SAMPLING PLAN

During the field effort, 27 deviations were made from the original SAP. The deviations are described below:

- One of the 25 monitoring wells (TW3) where fluid elevations were planned to be collected were not collected due to the presence of a MT DEQ lock on the well that prevented access.
- Three of the five production wells (PW3, PW4 and PW6) where fluid elevations were planned to be collected were not collected due to a lack direct measurement lines available from the well monitoring ports to a stable benchmark (e.g., ground surface). Well monitoring ports were located below ground surface in the vaults of the production well houses. Due to the lack of direct measurement lines from the well monitoring ports to a stable benchmark and inaccuracies in the measurement collection methods available, the percent error of the measurements that would have been obtained was believed to be greater than the accuracy and precision requirements for the project.
- Two of the 25 monitoring wells (TW8 and TW14) where fluid elevations were planned to be collected were inadvertently not collected.
- Surface water samples were planned to be analyzed for total metals only, but were also analyzed by the laboratory for dissolved metals per the direction of the Site Assessment Manager (SAM).
- Sample IDs were planned to contain the sample date in the mm/yy format at the end of the location ID (e.g. CF-SS-03-0913); however, the sample dates were inadvertently not included in the sample IDs. Sample dates were recorded in the field log books and chain-of-custodies.
- Sample IDs were planned to contain an “FF” in the sample ID (e.g. CF-GWFF-MW-03-0913) to indicate the sample was field filtered for all groundwater and surface water samples; however, the indicator was not included in the sample IDs due to the CLP sample ID containing an “5” to indicate field filtering (e.g. MH5099).
- Two of the sixteen groundwater locations (CF-GW-MW-12 and CF-GW-MW-15) and one of sixteen surface water locations (CF-SW-01) where water quality parameters were planned to be collected were inadvertently not collected.
- One groundwater sample location (CF-GW-MW-02) ran dry before the total and dissolved samples for TAL metals and cyanide analysis could be collected. Subsequently

W0004.1A.00115

the samples were collected the following day and the date and time recorded in the field log book and chain-of-custody.

- Both onsite surface water samples planned to be collected from the Cedar Creek Reservoir Overflow Drainage (CF-SW-02 and CF-SW-04) were not collected due to surface water not being present in the drainage.
- Three of the twelve co-located surface water/sediment samples planned to be collected from the Flathead River (CF-SW/SD-10 through CF-SW/SD-12) were not collected due to inaccessibility of the locations due to safety concerns.
- Two of the surface soil samples, CF-SS-04 and CF-SS-08, were moved from the areas near the plant to locations south of the Site and across the Flathead River on CFAC property to assess fluoride deposition offsite and downwind of the Site.
- The predetermined sample location for the co-located background surface water/sediment samples (CF-SW/SD-01) collected north of the areas of impact at the Site was difficult and dangerous to access. The sample location was moved approximately 350 feet north in the pond south of and adjacent to the reservoir dam.
- The predetermined sample location for the co-located surface water/sediment samples (CF-SW/SD-07) collected south and downgradient of the areas of impact at the Site adjacent to Outfall 006 was located in an area of stagnant water and the Outfall 006 could not be identified. The determination was made in the field to move the sample location approximately 1,000 feet west into the mixing zone of the Site discharge and the Flathead River.
- The predetermined sample location for the co-located surface water/waste sediment samples (CF-SW/WS-21) collected in the South Percolation Ponds was located in an area with no water present. The sample location was moved approximately 600 feet northwest to the pond adjacent to Outfall 005, which is the source for the South Percolation Ponds.
- The predetermined sample location for the co-located surface water/waste sediment samples (CF-SW/WS-22) collected in the South Percolation Ponds was located in an area with no water present. The sample location was moved approximately 500 feet southeast to the center of the pond where water was present.
- The predetermined sample location for one surface soil sample (CF-SS-03) collected west of the areas of impact at the Site was located in a clearing which appeared to be disturbed within the recent past by having the topsoil removed (possibly used as fill for the landfills). The intent of the sample location was to assess aerial deposition of fluoride and was therefore moved approximately 600 feet northeast into a wooded area with no evidence of ground disturbance.
- One of the three duplicate groundwater samples planned to be collected (CF-GW-MW-16) at sample location CF-GW-MW-03 was inadvertently not collected at that location. Subsequently, a duplicate groundwater sample was collected at sample location CF-GW-MW-05 instead.
- One of the three duplicate groundwater samples planned to be collected (CF-GW-MW-17) at sample location CF-GW-MW-11 was not collected due to project time constraints

W0004.1A.00115

as per the direction of the EPA SAM; however, the frequency of 1 duplicate per 20 samples as established in Site Inspection Guidance was met.

- One of the three duplicate surface water samples planned to be collected (CF-SW-24) at sample location CF-SW-15 was inadvertently not collected at that location. Subsequently, a duplicate surface water sample was collected at sample location CF-SW-16 instead.
- One matrix spike (MS)/matrix spike duplicate (MSD) groundwater sample planned to be collected (CF-GW-MW-01) was inadvertently not collected at that location. Subsequently, the MS/MSD groundwater sample was collected at sample location CF-GW-MW-10 instead.
- One of the two MS/MSD surface water samples planned to be collected (CF-SW-16) was inadvertently not collected at that location. Subsequently, the MS/MSD surface water sample was collected at sample location CF-SW-15 instead.
- One of the two MS/MSD surface soil samples planned to be collected (CF-SS-01) was inadvertently not collected at that location. Subsequently, the MS/MSD surface soil sample was collected at sample location CF-SS-02 instead.
- One of the groundwater samples (CF-GW-MW-03) collected for TAL metals analysis was planned to be preserved to a pH ≤ 2 . However, the sample pH was 10 and the addition of acid to the total metals sample was unsuccessful at reaching a pH below 5 without significant volume loss due to the matrix/acid reaction. Therefore, the total metals sample was submitted to the laboratory above the recommended pH and the dissolved TAL metals sample received no preservative in an effort to prevent volume loss due to reaction. As a result, the sample results may be biased low.
- One groundwater sample (CF-GW-MW-03) was planned to be analyzed for speciated nitrate/nitrite as N but was not analyzed by the laboratory within the 48-hour hold time due to the federal government shutdown. The lab that the samples were shipped to was a federal laboratory and was impacted by the federal government shutdown. The sample was subsequently analyzed for Total Nitrate/nitrite as N analysis within that analysis's holding time.
- One groundwater sample (CF-GW-OP-02) was planned to be analyzed for speciated nitrate/nitrite as N but was not received by the laboratory within the 48-hour hold time due to the federal government shutdown. The lab that the samples were shipped to was a federal laboratory and was impacted by the federal government shutdown. The sample was subsequently analyzed at a sub-contract laboratory for fluoride, but the analysis for nitrate/nitrite as N was outside of holding time and therefore the analysis cancelled.
- One sediment sample (CF-WS-21) was planned to be analyzed for VOCs, but the sample vials broke in the freezer prior to analysis by the laboratory; thus, the analysis was not completed.
- Six (including one duplicate) of the 23 waste sediment samples (CF-WS-17 through CF-WS-21) collected from the waste source percolation ponds were planned to be analyzed for PAHs, but the sample concentrations were too high to analyze at the low PAH

W0004.1A.00115

concentrations range; however, the analytes in the PAH method were analyzed for under the SVOC method.

3.5 QUALITY CONTROL

Soil, sediment, surface water, and groundwater samples were packaged on ice and shipped overnight via FedEx to the respective analytical laboratories. Quality control samples submitted for laboratory analysis for each media are discussed in the following sections.

3.5.1 Field Duplicates

A total of two groundwater (CF-GW-MW-16 and CF-GW-MW-18), three co-located surface water/sediment (CF-SW/SD-23 through CF-SW/SD-25), and one soil (CF-SS-09) duplicate sample(s) were collected. Field duplicates were collected and submitted for VOCs, SVOCs, PAHs, pesticides, PCBs, total and dissolved TAL metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc), fluoride, and nitrate/nitrite as N. Field duplicate samples are used to assess field precision.

3.5.2 Matrix Spike/Matrix Spike Duplicates

One groundwater (CF-GW-MW-10), two co-located surface water/sediment (CF-SW/SD-15 and CF-SW/SD-22), and one soil (CF-SS-02) sample(s) were collected and submitted for MS/MSD analysis of VOCs, SVOCs, PAHs, pesticides, PCBs, total and dissolved TAL metals, fluoride, and nitrate/nitrite as N (surface water and groundwater samples only). The recoveries of the spiked analytes are used to assess accuracy within a given matrix. Comparison of the MS to the MSD is used to assess precision within a given matrix.

3.5.3 Equipment Blanks

One equipment blank (CF-GW-EB-01) was collected from the Grundfos Redi-Flow 2 submersible pump used for collecting groundwater samples and analyzed for VOCs, SVOCs, PAHs, pesticides, PCBs, total and dissolved TAL metals, fluoride, and nitrate/nitrite as N (surface water and groundwater samples only). The sample is used to assure the quality of the samples collected. Results for the equipment blank samples are presented in Tables E54-E61, Appendix E.

3.5.4 Field Blanks

A total of two field blanks (Field Blank 1 and Field Blank 2) were collected during the field sampling activities. Field Blank 1 was collected prior to collection of and at the sample location of CF-SW/SD-08. Field Blank 2 was collected prior to collection of and at the sample location of CF-GW-MW-01. Both samples were analyzed for VOCs, SVOCs, PAHs, pesticides, PCBs, total and dissolved TAL metals, fluoride, and nitrate/nitrite as N (surface water and groundwater samples only). It is used to identify errors or contamination in sample handling, collection, and analysis. Results for the field blank samples are presented in Tables E54-E61, Appendix E.

W0004.1A.00115

3.5.5 Trip Blanks

A total of 41 trip blanks (Trip Blank 1 through Trip Blank 42 [Trip Blank 9 was not assigned]) were submitted during the field sampling activities. Trip blank samples were submitted in sample coolers with VOC samples only and were only analyzed by the laboratory for VOCs. They are used to identify errors or contamination in sample handling, collection, and analysis. Results for the trip blank samples are presented in Table E54, Appendix E.

W0004.1A.00115

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3.6 SCREENING BENCHMARKS

The sample data collected during this investigation were reviewed using the HRS guidelines for analytical interpretation (40 Code of Federal Regulations Part 300 Appendix A, 55 FR 51583). Potentially applicable regulatory benchmarks and other risk-based criteria used for comparison purposes are listed below and are also included in Data Summary Tables (Appendix E). The exceedances of these benchmarks do not automatically indicate a response action is warranted. Benchmarks for the CFAC Site include the following:

- Superfund Chemical Data Matrix (SCDM) Hazardous Substance Benchmarks (EPA, 2014)
- Montana Department of Environmental Quality (MT DEQ) Numeric Water Quality Standards (WQS), Human Health and Aquatic Life Standards (MT DEQ, 2012)
- EPA Regional Screening Level (RSL), Residential Soil, Industrial Soil, and Tapwater (EPA, 2013)

The SCDM benchmark values are used for applying the HRS. The MT DEQ WQS and EPA RSLs are included to provide comparison to the most conservative (i.e., most restrictive) regulatory or risk-based benchmarks and provide a baseline level of comparative risk.

Current investigation sample results are also being compared to site-specific background concentrations. In accordance with EPA guidance, observed contamination is documented when a hazardous substance is detected at a concentration equal to or greater than three times the detected background concentration. If an analyte is not detected in background samples, then observed contamination is documented when the sample measurement equals or exceeds the sample quantitation limit (i.e., the laboratory reporting limit) of the background sample.

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4.0 INVESTIGATION RESULTS

The following sections outline the analytical results for the current investigation. Data summary tables are presented in Appendix E as follows:

- Table E1 Source Ground Water VOCs Analytical Results Summary
- Table E2 Source Ground Water SVOCs Analytical Results Summary
- Table E3 Source Ground Water PAHs Analytical Results Summary
- Table E4 Source Ground Water Pesticides Analytical Results Summary
- Table E5 Source Ground Water PCBs Analytical Results Summary
- Table E6 Source Ground Water TAL Metals Analytical Results Summary
- Table E7 Source Ground Water Dissolved Metals Analytical Results Summary
- Table E8 Source Ground Water General Chemistry Analytical Results Summary

- Table E9 Source Surface Water VOCs Analytical Results Summary
- Table E10 Source Surface Water SVOCs Analytical Results Summary
- Table E11 Source Surface Water PAHs Analytical Results Summary
- Table E12 Source Surface Water Pesticides Analytical Results Summary
- Table E13 Source Surface Water PCBs Analytical Results Summary
- Table E14 Source Surface Water TAL Metals Analytical Results Summary
- Table E15 Source Surface Water Dissolved Metals Analytical Results Summary
- Table E16 Source Surface Water General Chemistry Analytical Results Summary

- Table E17 Source Sediment VOCs Analytical Results Summary
- Table E18 Source Sediment SVOCs Analytical Results Summary
- Table E19 Source Sediment PAHs Analytical Results Summary
- Table E20 Source Sediment Pesticides Analytical Results Summary
- Table E21 Source Sediment PCBs Analytical Results Summary
- Table E22 Source Sediment TAL Metals Analytical Results Summary
- Table E23 Source Sediment General Chemistry Analytical Results Summary

- Table E24 Ground Water VOCs Analytical Results Summary
- Table E25 Ground Water SVOCs Analytical Results Summary
- Table E26 Ground Water PAHs Analytical Results Summary
- Table E27 Ground Water Pesticides Analytical Results Summary
- Table E28 Ground Water PCBs Analytical Results Summary
- Table E29 Ground Water TAL Metals Analytical Results Summary
- Table E30 Ground Water Dissolved Metals Analytical Results Summary
- Table E31 Ground Water General Chemistry Analytical Results Summary

- Table E32 Surface Water VOCs Analytical Results Summary
- Table E33 Surface Water SVOCs Analytical Results Summary
- Table E34 Surface Water PAHs Analytical Results Summary
- Table E35 Surface Water Pesticides Analytical Results Summary
- Table E36 Surface Water PCBs Analytical Results Summary

W0004.1A.00115

▪ Table E37	Surface Water TAL Metals Analytical Results Summary
▪ Table E38	Surface Water Dissolved Metals Analytical Results Summary
▪ Table E39	Surface Water General Chemistry Analytical Results Summary
▪ Table E40	Sediment VOCs Analytical Results Summary
▪ Table E41	Sediment SVOCs Analytical Results Summary
▪ Table E42	Sediment PAHs Analytical Results Summary
▪ Table E43	Sediment Pesticides Analytical Results Summary
▪ Table E44	Sediment PCBs Analytical Results Summary
▪ Table E45	Sediment TAL Metals Analytical Results Summary
▪ Table E46	Sediment General Chemistry Analytical Results Summary
▪ Table E47	Soil VOCs Analytical Results Summary
▪ Table E48	Soil SVOCs Analytical Results Summary
▪ Table E49	Soil PAHs Analytical Results Summary
▪ Table E50	Soil Pesticides Analytical Results Summary
▪ Table E51	Soil PCBs Analytical Results Summary
▪ Table E52	Soil TAL Metals Analytical Results Summary
▪ Table E53	Soil General Chemistry Analytical Results Summary
▪ Table E54	Quality Assurance Water VOCs Analytical Results Summary
▪ Table E55	Quality Assurance Water SVOCs Analytical Results Summary
▪ Table E56	Quality Assurance Water PAHs Analytical Results Summary
▪ Table E57	Quality Assurance Water Pesticides Analytical Results Summary
▪ Table E58	Quality Assurance Water PCBs Analytical Results Summary
▪ Table E59	Quality Assurance Water TAL Metals Analytical Results Summary
▪ Table E60	Quality Assurance Water Dissolved Metals Analytical Results Summary
▪ Table E61	Quality Assurance Water General Chemistry Analytical Results Summary

Laboratory samples were analyzed by four CLP laboratories and one subcontract laboratory. CLP laboratories include: Chemtech Consulting Group in Mountainside, New Jersey; ALS Laboratory Group in Salt Lake City, Utah; Environmental Services Assistance Team (ESAT) laboratory in Golden, Colorado; and Liberty Analytical Corporation in Cary, North Carolina. The subcontract laboratory used was Accutest in Wheat Ridge, Colorado. Laboratory analytical and data validation reports are presented in Appendix F.

4.1 SOURCE SAMPLE RESULTS

4.1.1 Waste Source Results

The landfills (West, East, Sanitary, and Center Landfills) and waste ponds (Wet Scrubber Sludge, North Leachate, and South Leachate Ponds) sources were not sampled so as to not compromise the integrity of the caps or covers. Therefore, they are being evaluated through groundwater samples (CF-GW-MW-02 through CF-GW-MW-07 [Figure 5]) to characterize contaminants associated with them. There may be other sources of contamination onsite that are

W0004.1A.00115

unknown at this time and evaluation of these groundwater sample locations does not infer the adjacent waste sources are the only contaminant sources present onsite.

The source groundwater analytical results are presented in Tables E1-E8, Appendix E. Laboratory data and validation reports are presented in Appendix F. Water quality field parameters are presented in Table C2, Appendix C. Contaminant concentrations in source groundwater were considered detections when the result was greater than the analytical reporting limit, indicating these contaminants are potentially associated with a source area. Results flagged with a J, were applied a matrix factor as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996) to determine if the calculated result was above the analytical reporting limit. Contaminants detected in source groundwater samples include:

Total metals - aluminum, arsenic, calcium, chromium, cobalt, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, and zinc.

Dissolved metals - aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, and zinc.

General Chemistry - fluoride and nitrate/nitrite as N.

The analytical results of the groundwater samples CF-GW-MW-02 through CF-GW-MW-07 from locations adjacent to and downgradient of the landfills (West, East, Sanitary, and Center Landfills) and waste ponds (Wet Scrubber Sludge, North Leachate, and South Leachate Ponds) sources were also compared to the observed release criteria (three times background concentration) to determine if the downgradient concentrations are significantly elevated above background concentrations. This analysis is discussed in Section 4.2.2.

4.1.2 North Percolation Ponds Source Surface Water and Waste Sediment Results

4.1.2.1 Surface Water

The analytical results of the source surface water samples (CF-SW-19 and duplicate [CF-SW-25], and CF-SW-20 [Figure 6]) from the North Percolation Ponds are presented in Tables E9-E16, Appendix E. Laboratory data and validation reports are presented in Appendix F. Water quality field parameters are presented in Table C2, Appendix C. Contaminant concentrations in source surface water were considered detections when the result was greater than the analytical reporting limit. Results flagged with a J, were applied a matrix factor as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996) to determine if the calculated result was above the analytical reporting limit. Contaminants detected in source surface water samples collected from the North Percolation Ponds include:

SVOCs - chrysene, fluoranthene and pyrene.

Total metals - aluminum, arsenic, barium, calcium, copper, cyanide, iron, lead, magnesium, manganese, nickel, sodium, vanadium, and zinc.

W0004.1A.00115

Dissolved metals - aluminum, barium, calcium, magnesium, manganese, nickel, sodium, vanadium, and zinc.

General Chemistry - fluoride.

4.1.2.2 Waste Sediment

The analytical results of the waste sediment samples (CF-WS-17 through CF-WS-20 and CF-WS-25 (duplicate for CF-WS-19) [Figure 6]) from the North Percolation Ponds are presented in Tables E17-E23, Appendix E. Laboratory data and validation reports are presented in Appendix F. Contaminant concentrations in source sediment were considered detections when the result was greater than the analytical reporting limit. Results flagged with a J, were applied a matrix factor as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996) to determine if the calculated result was above the analytical reporting limit. Contaminants detected in waste sediment samples collected from the North Percolation Ponds include:

SVOCs - anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene.

Pesticides - 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, beta-bhc, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, gamma-chlordane, heptachlor epoxide, and methoxychlor.

Total metals - aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, thallium, vanadium, and zinc.

General Chemistry - fluoride.

4.1.3 South Percolation Ponds Source Surface Water and Waste Sediment Results

4.1.3.1 Surface Water

The analytical results of the source surface water samples (CF-SW-21 and CF-SW-22 [Figure 6]) from the South Percolation Ponds are presented in Tables E9-E16, Appendix E. Laboratory data and validation reports are presented in Appendix F. Water quality field parameters are presented in Table C2, Appendix C. Contaminant concentrations in source surface water were considered detections when the result was greater than the analytical reporting limit. Results flagged with a J, were applied a matrix factor as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996) to determine if the calculated result was above the analytical reporting limit. Contaminants detected in source surface water samples collected from the South Percolation Ponds include:

SVOCs - dimethylphthalate.

Total metals - aluminum, arsenic, barium, calcium, chromium, cobalt, copper, cyanide, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc.

W0004.1A.00115

Dissolved metals - aluminum, barium, calcium, copper, magnesium, manganese, nickel, potassium, sodium, and zinc.

General Chemistry - fluoride.

4.1.3.2 Waste Sediment

The analytical results of the waste sediment samples (CF-WS-21 and CF-WS-22 [Figure 6]) from the South Percolation Ponds are presented in Tables E17-E23, Appendix E. Laboratory data and validation reports are presented in Appendix F. Contaminant concentrations in source sediment were considered detections when the result was greater than the analytical reporting limit. Results flagged with a J, were applied a matrix factor as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996) to determine if the calculated result was above the analytical reporting limit. Contaminants detected in waste sediment samples collected from the South Percolation Ponds include:

SVOCs - benzo(b)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene.

Pesticides - endrin ketone and gamma-chlordane.

Total metals – aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, vanadium, and zinc.

General Chemistry - fluoride.

W0004.1A.00115

4.2 GROUNDWATER SAMPLE RESULTS

4.2.1 Background Groundwater Results

Per EPA *Guidance for Performing Site Inspections Under CERCLA* (EPA, 1992), background data was collected for comparison against site-specific analytical results. The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated groundwater background samples collected from MW-01 (CF-GW-MW-01 and CF-GW-MW-18 [duplicate] [Figure 5]) (Tables E1-E8 and E24-E31, Appendix E). Water quality field parameters are presented in Table C2, Appendix C. Laboratory data and validation reports are presented in Appendix F.

4.2.2 Onsite Groundwater Results

The analytical results of the groundwater samples CF-GW-MW-02 through CF-GW-MW-11 from locations adjacent to and downgradient of the landfills (West, East, Sanitary, and Center Landfills) and waste ponds (Wet Scrubber Sludge, North Leachate, South Leachate, North Percolation, and South Percolation Ponds) sources were compared to the observed release criteria (three times background concentration). The three times background was calculated for each analyte using the highest detected laboratory result of the evaluated groundwater background samples (CF-GW-MW-01 and CF-GW-MW-18 [duplicate] [Figure 5]). If the background results are non-detect for a specific analyte, then a detection in a release sample above the reporting limit of the background sample for the associated analyte is considered an exceedance of the background concentration. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996).

Hazardous materials associated with the landfills (West, East, Sanitary, and Center Landfills) and waste ponds (Wet Scrubber Sludge, North Leachate, South Leachate, North Percolation, and South Percolation Ponds) sources (identified by groundwater monitoring wells) present at concentrations that exceed the three times background concentration include: aluminum, arsenic, chromium, cobalt, copper, cyanide, iron, lead, nickel, potassium, selenium, sodium, vanadium, zinc, fluoride, and nitrate/nitrite as N. Laboratory data and validation reports are presented in Appendix F. The following is a summary by contaminant of the highest detected analytical results among the onsite monitoring wells that exceed observed release criteria and are significant to the Site, as they were also detected in source samples.

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4.2.2.1 Total TAL Metals

Source of Observed Release	Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Landfills/ Waste Ponds	Chromium	CF-GW-MW-01	6.11	2	CF-GW-MW-03	156J	2
Landfills/ Waste Ponds	Cobalt	CF-GW-MW-01	10.40	1	CF-GW-MW-03	346J	1
Landfills/ Waste Ponds	Copper	CF-GW-MW-01	11.875	2	CF-GW-MW-03	308J	2
Landfills/ Waste Ponds	Cyanide	CF-GW-MW-18	18.77	10	CF-GW-MW-04	1,040J-	10
Landfills/ Waste Ponds	Iron	CF-GW-MW-01	7938	200	CF-GW-MW-03	37,900J	200
Landfills/ Waste Ponds	Lead	CF-GW-MW-01	9.17	1	CF-GW-MW-02	59.3J	1
Landfills/ Waste Ponds	Nickel	CF-GW-MW-01	7.74	1	CF-GW-MW-03	155J	1
Landfills/ Waste Ponds	Potassium	CF-GW-MW-01	1724	500	CF-GW-MW-03	23,400J	500
Landfills/ Waste Ponds	Selenium	CF-GW-MW-01	ND	5	CF-GW-MW-03	94.2J	5
Landfills/ Waste Ponds	Sodium	CF-GW-MW-18	5065	500	CF-GW-MW-03	4,840,000J-	500
Landfills/ Waste Ponds	Vanadium	CF-GW-MW-01	ND	4.1	CF-GW-MW-03	2,480J	5

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Source of Observed Release	Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Landfills/ Waste Ponds	Zinc	CF-GW-MW-01	75.72	2	CF-GW-MW-09	5,070J-	2

4.2.2.2 Dissolved TAL Metals

Source of Observed Release	Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Landfills/ Waste Ponds	Aluminum	CF-GW-MW-01	10.85	20	CF-GW-MW-03	74.6J	20
Landfills/ Waste Ponds	Arsenic	CF-GW-MW-01	ND	1	CF-GW-MW-03	344	1
Landfills/ Waste Ponds	Barium	CF-GW-MW-18	70.2	10	CF-GW-MW-09	349	10
Landfills/ Waste Ponds	Chromium	CF-GW-MW-01	ND	2	CF-GW-MW-03	10.3	2
Landfills/ Waste Ponds	Cobalt	CF-GW-MW-01	ND	1	CF-GW-MW-03	344	1
Landfills/ Waste Ponds	Copper	CF-GW-MW-01	ND	2	CF-GW-MW-03	260	2
Landfills/ Waste Ponds	Iron	CF-GW-MW-01	301	200	CF-GW-MW-03	24,000	200

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Source of Observed Release	Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Landfills/ Waste Ponds	Lead	CF-GW-MW-01	ND	1	CF-GW-MW-02	3.1	1
Landfills/ Waste Ponds	Manganese	CF-GW-MW-18	11	1	CF-GW-MW-09	181	1
Landfills/ Waste Ponds	Nickel	CF-GW-MW-01	1.122	1	CF-GW-MW-03	62.8	1
Landfills/ Waste Ponds	Potassium	CF-GW-MW-18	530	500	CF-GW-MW-03	23,100J	500
Landfills/ Waste Ponds	Selenium	CF-GW-MW-01	ND	5	CF-GW-MW-03	96.4	5
Landfills/ Waste Ponds	Sodium	CF-GW-MW-18	3840	500	CF-GW-MW-03	5,200,000J	500
Landfills/ Waste Ponds	Vanadium	CF-GW-MW-01	ND	5	CF-GW-MW-03	3,060	5
Landfills/ Waste Ponds	Zinc	CF-GW-MW-01	ND	2	CF-GW-MW-02	76.2	2

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4.2.2.3 General Chemistry

Source of Observed Release	Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Landfills/ Waste Ponds	Fluoride	CF-GW-MW-01	100J	200	CF-GW-MW-03	190,000	20000
Landfills/ Waste Ponds	Nitrate/Nitrite as N	CF-GW-MW-01	ND	500	CF-GW-MW-03	193,000	50000

The Site groundwater analytical results for CF-GW-MW11 were also compared to the SCDMs Drinking Water Standards, the MT DEQ WQS for Human Health, and the EPA Tapwater RSLs since this is an onsite production well used for potable water (Tables E24-E31, Appendix E). The detected analytical results for zinc and fluoride exceeded the three times background concentration and are significant to the Site, as they were also detected in source samples; however, the concentrations do not exceed any of the human health screening benchmarks. Water quality field parameters are presented in Table C2, Appendix C. Laboratory data and validation reports are presented in Appendix F.

In addition, analytical results of the onsite groundwater monitoring wells samples indicate observed concentrations of dichlorodifluoromethane and 4-methylphenol that exceed the three times background concentration, but were not detected in any of the source samples.

4.2.3 Residential Groundwater Results

The analytical results of the groundwater samples from residential wells (CF-GW-MW-12 through CF-GW-MW-15 [Figure 5]) sampled were compared to the three times background concentration for water to further ensure that contaminants attributed to site activities were not also naturally occurring at similar concentrations. The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated groundwater background samples (CF-GW-MW-01 and CF-GW-MW-18 [duplicate]). If the background results are non-detect for a specific analyte, then a detection in a release sample above the reporting limit in the background sample for the associated analyte is considered an exceedance of the background concentration. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to*

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Document an Observed Release and Observed Contamination (EPA, 1996). The residential groundwater analytical results were also compared to the SCDMs Drinking Water Standards, the MT DEQ WQS for Human Health, and the EPA Tapwater RSLs (Appendix E). Water quality field parameters are presented in Table C2, Appendix C.

There is an observed release to off-site, residential groundwater for aluminum, barium, copper, cyanide, manganese, potassium, zinc, and nitrate/nitrite as N; however, only cyanide exceeds the EPA Tapwater RSL human health screening benchmark. Laboratory data and validation reports are presented in Appendix F. The following is a summary by contaminant of the highest detected analytical results among the off-site residential wells that exceed the three times background concentration and are significant to the Site, as they were also detected in source samples.

4.2.3.1 Total TAL Metals

Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Cyanide	CF-GW-MW-18	18.77	10	CF-GW-OP-02	111	10

4.2.3.2 Dissolved TAL Metals

Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Aluminum	CF-GW-MW-01	10.85	20	CF-GW-MW-15	265	20
Barium	CF-GW-MW-18	70.2	10	CF-GW-OP-02	380	10
Copper	CF-GW-MW-01	ND	2	CF-GW-MW-12	6	2

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Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Manganese	CF-GW-MW-18	11	1	CF-GW-OP-02	295	1
Potassium	CF-GW-MW-18	530	500	CF-GW-MW-12	1,980	500
Zinc	CF-GW-MW-01	ND	2	CF-GW-MW-12	89J	2

4.2.3.3 General Chemistry

Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Nitrate/Nitrite as N	CF-GW-MW-01	ND	500	CF-GW-MW-12	900	500

In addition, analytical results of the residential groundwater wells samples indicate an observed concentration of naphthalene that exceeds the three times background concentration and the EPA Tapwater RSL benchmark, but was not detected above the reporting limit in any of the source samples.

4.3 SURFACE WATER SAMPLE RESULTS

4.3.1 Cedar Creek Background Surface Water Results

The three times background concentration was calculated for each analyte using the detected laboratory result of the surface water background sample collected from SW-01 (CF-SW-01 [Figure 6]) (Tables E32-E39, Appendix E). Water quality field parameters are presented in Table C2, Appendix C. Laboratory data and validation reports are presented in Appendix F.

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4.3.2 Cedar Creek Surface Water Results

The analytical results of the Cedar Creek surface water location (CF-SW-03 [Figure 6]) sampled were compared to the three times background concentration for surface water to further ensure that contaminants attributed to site activities were not also naturally occurring at similar concentrations. The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated Cedar Creek surface water background sample (CF-SW-01). If the background results are non-detect for a specific analyte, then a detection in the release sample above the reporting limit of the background Cedar Creek sample for the associated analyte is considered an exceedance of the background concentration. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996). The Cedar Creek surface water analytical results were also compared to the SCDM Acute and SCDM Chronic Standards and the MT DEQ Aquatic Life Acute and MT DEQ Aquatic Life Chronic benchmarks (Tables E32-E39, Appendix E).

An observed release to surface water was documented with Cedar Creek surface water samples for copper, cyanide, and potassium; however, only cyanide concentrations exceed one or more of the aquatic life screening benchmarks. Laboratory data and validation reports are presented in Appendix F. The following is a summary by contaminant of the highest detected analytical results among the onsite surface water samples that exceed the three times background concentration and are significant to the Site, as they were also detected in source samples.

4.3.2.1 Total TAL Metals

Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Copper	CF-SW-01	ND	2	CF-SW-03	4.9J-	2
Cyanide	CF-SW-01	ND	10	CF-SW-03	43.4J-	10
Potassium	CF-SW-01	ND	500	CF-SW-03	593J-	500

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4.3.2.2 Dissolved TAL Metals

Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Potassium	CF-SW-01	ND	500	CF-SW-03	625	500

4.3.3 Flathead River Background Surface Water Results

The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated surface water background samples collected from SW-13, SW-14, SW-15, SW-16 (CF-SW-13, CF-SW-14, CF-SW-15, CF-SW-16, and CF-SW-24 [duplicate] [Figure 6]) (Tables E32-E39, Appendix E). Water quality field parameters are presented in Table C2, Appendix C. Laboratory data and validation reports are presented in Appendix F.

4.3.4 Flathead River Surface Water Results

The analytical results of the Flathead River surface water samples (CF-SW-05 through CF-SW-16 [Figure 6]) were compared to the three times background concentration for surface water to further ensure that contaminants attributed to site activities were not also naturally occurring at similar concentrations. The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated Flathead River surface water background samples (CF-SW-13, CF-SW-14, CF-SW-15, CF-SW-16, CF-SW-24 [duplicate] [Tables E32-E39, Appendix E]). If the background results are non-detect for a specific analyte, then a detection in a release sample above the reporting limit for the Flathead River background sample for the associated analyte is considered an exceedance of the background concentration. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996). The Flathead River results were also compared to the SCDM Acute and SCDM Chronic Standards and the MT DEQ Aquatic Life Acute and MT DEQ Aquatic Life Chronic benchmarks (Tables E32-E39, Appendix E).

An observed release to surface water was documented with Flathead River surface water samples for manganese, sodium, and zinc, and fluoride; however, none of the concentrations exceed any of the aquatic life screening benchmarks. Laboratory data and validation reports are presented in Appendix F. The following is a summary by contaminant of the highest detected analytical results

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among the Flathead River surface water samples that exceed the three times background concentration and are significant to the Site, as they were also detected in source samples.

4.3.4.1 Total TAL Metals

Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Manganese	CF-SW-13	8.9	1	CF-SW-07	27.3J-	1
Sodium	CF-SW-15	1373	500	CF-SW-23	4,980J-	500

4.3.4.2 Dissolved TAL Metals

Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Manganese	CF-SW-13	2.2	1	CF-SW-07	31.4	1
Sodium	CF-SW-13	1449	500	CF-SW-07	6,940	500
Zinc	CF-SW-13	ND	2	CF-SW-05	2.7J	2

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4.3.4.3 General Chemistry

Contaminant	Background Sample ID	Background Concentration (µg/L)	Background RL (µg/L)	Release Sample ID with Highest Concentration	Highest Sample Concentration (µg/L)	Sample RL (µg/L)
Fluoride	CF-SW-16	110	100	CF-SW-07	500	100

In addition, an analytical result of the Flathead River surface water samples indicate an observed concentration of carbon disulfide above three times background, but it was not detected in any of the source samples.

4.4 SEDIMENT SAMPLE RESULTS

4.4.1 Cedar Creek Background Sediment Results

The three times background concentration was calculated for each analyte using the detected laboratory result of the sediment background sample collected from SD-01 (CF-SD-01 [Figure 6]) (Tables E40-E46, Appendix E). Laboratory data and validation reports are presented in Appendix F.

4.4.2 Cedar Creek Sediment Results

The analytical results of the Cedar Creek sediment location (CF-SD-03 [Figure 6]) sampled were compared to the three times background concentration for sediment to further ensure that contaminants attributed to site activities were not also naturally occurring at similar concentrations. The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated Cedar Creek sediment background sample (CF-SD-01). If the background results are non-detect for a specific analyte, then a detection in a release sample above the reporting limit for the background Cedar Creek sample for the associated analyte is considered an exceedance of the background concentration. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996). The Cedar Creek sediment analytical results are presented in Tables E40-E46, Appendix E.

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None of the detected analytical results exceeded the three times background concentration. Laboratory data and validation reports are presented in Appendix F.

4.4.3 Cedar Creek Reservoir Overflow Drainage Background Sediment Results

The three times background concentration was calculated for each analyte using the detected laboratory result of the sediment background sample collected from SD-02 (CF-SD-02 [Figure 6]) (Tables E40-E46, Appendix E). Laboratory data and validation reports are presented in Appendix F.

4.4.4 Cedar Creek Overflow Drainage Sediment Results

The analytical results of the Cedar Creek Reservoir Overflow Drainage sediment locations (CF-SD-04 and CF-SD-OP-01 [Figure 6]) sampled were compared to the three times background concentration for sediment to further ensure that contaminants attributed to site activities were not also naturally occurring at similar concentrations. The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated Cedar Creek Reservoir Overflow Drainage surface water background sample (CF-SD-02). If the background results are non-detect for a specific analyte, then a detection in a release sample above the reporting limit for the background Cedar Creek Reservoir Overflow Drainage sediment sample for the associated analyte is considered an exceedance of the background concentration. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996). The Cedar Creek Reservoir Overflow Drainage sediment analytical results are presented in Tables E40-E46, Appendix E.

None of the detected analytical results exceeded the three times background concentration. Laboratory data and validation reports are presented in Appendix F.

4.4.5 Flathead River Background Sediment Results

The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated sediment background samples collected from SW-13, SW-14, SW-15, SW-16 (including duplicate) (CF-SW-13, CF-SW-14, CF-SW-15, CF-SW-16, and CF-SW-24 [duplicate] [Figure 6]) (Tables E40-E46, Appendix E). Laboratory data and validation reports are presented in Appendix F.

W0004.1A.00115

4.4.6 Flathead River Sediment Results

The analytical results of the Flathead River sediment samples (CF-SD-05 through CF-SD-16 [Figure 6]) were compared to the three times background concentration for sediment to further ensure that contaminants attributed to site activities were not also naturally occurring at similar concentrations. The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated Flathead River sediment background samples (CF-SD-05, CF-SD-06, CF-SD-07, CF-SD-23 [duplicate], CF-SD-08, CF-SD-09). If the background results are non-detect for a specific analyte, then a detection in a release sample above the reporting limit for the background Flathead River sediment sample for the associated analyte is considered an exceedance of the background concentration. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996). The Flathead River results are presented in Tables E40-E46, Appendix E.

An observed release to sediment was documented with Flathead River sediment samples for cyanide and fluoride. Laboratory data and validation reports are presented in Appendix F. The following is a summary by contaminant of the highest detected analytical result among the onsite surface water samples that exceed the three times background concentration and are significant to the Site, as they were also detected in source samples.

4.4.6.1 Total TAL Metals

Contaminant	Background Sample ID	Background Concentration (mg/kg)	Background RL (mg/kg)	Release Sample ID with Highest Concentration	Highest Sample Concentration (mg/kg)	Sample RL (mg/kg)
Cyanide	CF-SD-16	ND	0.63	CF-SD-07	1.8J-	0.58

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4.4.6.3 General Chemistry

Contaminant	Background Sample ID	Background Concentration (mg/kg)	Background RL (mg/kg)	Release Sample ID with Highest Concentration	Highest Sample Concentration (mg/kg)	Sample RL (mg/kg)
Fluoride	CF-SD-15	ND	2.6	CF-SD-07	9.5	2.8

4.5 SOIL SAMPLE RESULTS

4.5.1 Background Soil Results

The three times background concentration was calculated for each analyte using the highest detected laboratory result of the evaluated soil background samples (CF-SS-01, CF-SS-02 and CF-SS-09 [duplicate] [Figure 7]). The soil analytical results were also compared to the SCDMs and EPA RSLs (Table E47-E53, Appendix E). Laboratory data and validation reports are presented in Appendix F.

4.5.2 Site Soil Results

Soil samples (CF-SS-03 through CF-SS-08 [Figure 7]) were collected and analyzed for fluoride. The analytical results of the soil samples were compared to the three times background concentration for soil. The three times background concentration was calculated using the highest detected laboratory result of the evaluated soil background samples (CF-SS-01, CF-SS-02 and CF-SS-09 [duplicate]). The soil analytical results were also compared to the SCDM CRSC and RDSC, and EPA RSLs (Table E47-E53, Appendix E). Laboratory data and validation reports are presented in Appendix F.

Fluoride concentrations range from 15.2 mg/kg (CF-SS-06) to 27.6 mg/kg (CF-SS-07). Detected fluoride in CF-SS-05 through CF-SS-07 exceeds the three times background (11.4 mg/kg); however, they do not exceed any of the soil screening benchmarks.

4.6 DATA GAPS

Data gaps exist in the data collected as part of the September 2013 field investigation. Data gaps identified in the field data collected include, but are not limited to, incomplete well boring logs, fluid elevations and well total depths, well survey data, and sample water quality parameters. Analytical data gaps identified include, but are not limited to, sample results that were rejected and qualified total

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and dissolved TAL metals results for CF-GW-MW-03. The samples with one or more rejected analytes for VOCs, SVOCs, PAHs, pesticides, and PCBs include groundwater, surface water, sediment and soil and are due to serious deficiencies in the ability to analyze the sample and to meet quality control criteria. The qualified total and dissolved TAL metals results for CF-GW-MW-03 are biased low due to sample preservation complications in the field.

4.7 ENVIRONMENTAL AND/OR HUMAN IMPACT

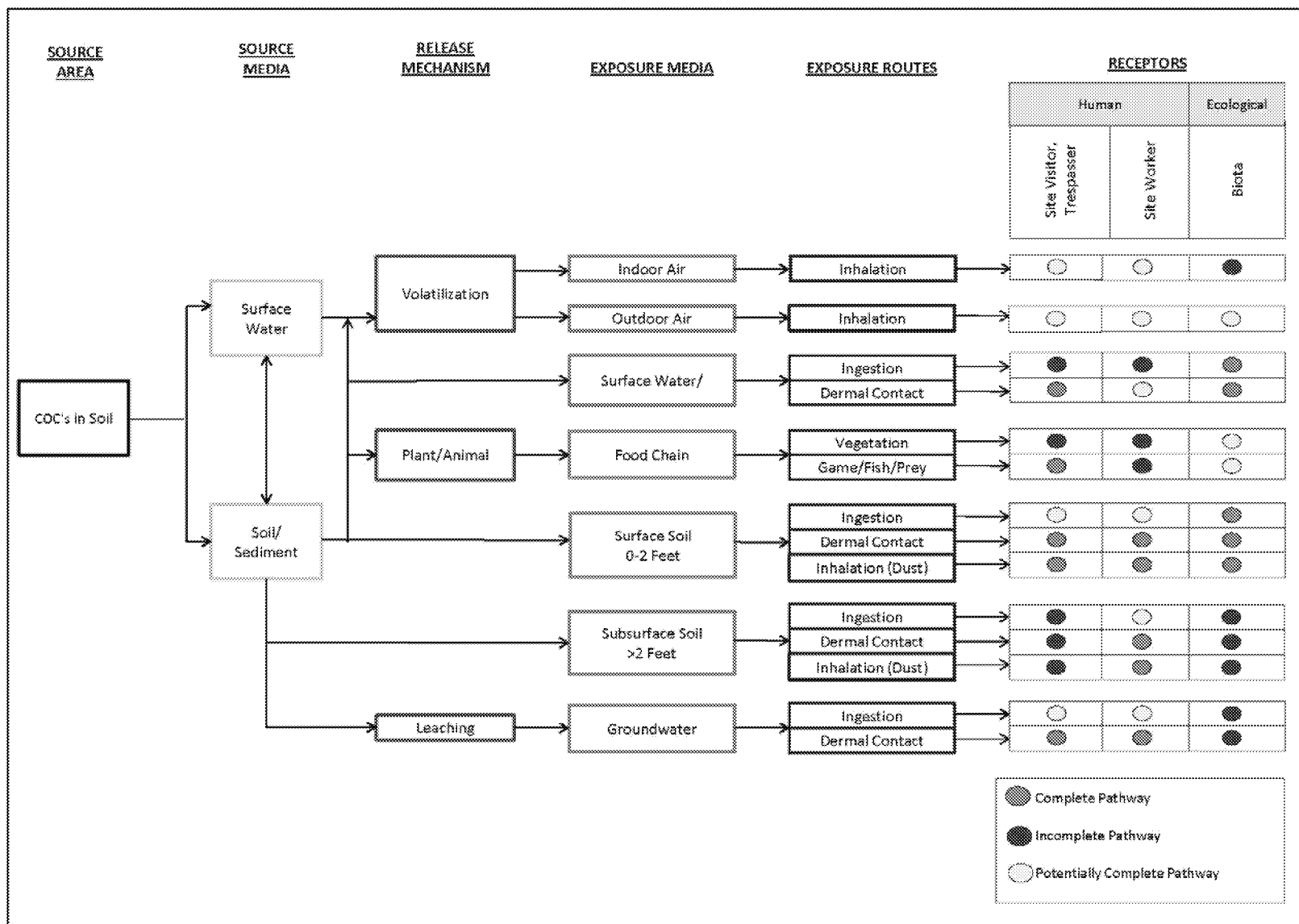
Historic industrial activities and resulting burial of potentially hazardous materials have impacted soil, sediment, groundwater, and surface water in the area with concentrations of heavy metals, cyanide, fluoride, nitrate/nitrite as N, VOCs, SVOCs, PAHs, and pesticides that exceed area background concentrations and/or screening benchmarks.

Because COCs have been identified in surface and subsurface soils (in previous investigations), surface water, and groundwater in various locations throughout the Site and offsite, the pathways for COCs are considered complete. COCs have been identified at levels over the screening criteria for surface soil, sediment, surface water, and groundwater samples collected during the SR, and above the detection limits in surface and subsurface soils during previous onsite remedial activities. Therefore, pathways for human and ecological receptor contact with COCs are considered complete (Flow Chart 1).

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Flow Chart 1 - Complete Exposure Pathways for Receptors to COC's at the CFAC



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4.8 DATA QUALITY ASSESSMENT

1. State the Problem

Remnants of historical industrial activities are present within the Site, which include numerous buildings and industrial operating facilities such as warehouses, fabrication, laboratory, paste plant, coal tar pitch tanks, pump houses, the main pot line facility, percolation ponds, leachate ponds, sludge ponds, sewage treatment ponds, cathode soaking pits, closed and operational landfills. The Site has historically had contamination to soils, sediments, and groundwater that include PCBs, PAHs, heavy metals, cyanide, and fluoride, all of which were attributable to plant processes as described in the previous investigations conducted on the Site. Potential contaminants, in addition to the aforementioned, related to historic site use include VOCs, SVOCs, and pesticides. Historical industrial activities have resulted in an observed release of hazardous substances to the groundwater and surface water.

This investigation involved the generation of definitive data for surface water, groundwater, soil, sediment, and waste sediment material. All definitive analytical methods employed for this project were methods approved by the EPA.

2. Identify the Goals of the Study

Identifying the goal of the study involves establishing principal study questions, actions that may result from answering the questions, and development of decision statements that will be used to resolve principal study questions. In addition, potential outcomes requiring new environmental data to address the problem statement may result from decision statements, if the goals are limited in scope.

Principal study questions: The field sampling was conducted to provide data as needed at the site to determine:

- 1) Using laboratory analysis, has an observed release (based on the CERCLA definition [EPA, 1992]) of metals and cyanide, fluoride, VOCs, SVOCs, PAHs, PCBs, and/or pesticides occurred to soil, sediments, waste sediments, surface water, or groundwater at the Site as a result of historic industrial activities (i.e., are any contaminants present in the soil, sediments, waste sediments, surface water or groundwater in concentrations greater than three times background?)
- 2) What are the contaminant levels at background sources?
- 3) What are the current groundwater flow patterns?
- 4) What are the HRS targets?

Assessment Responses to Principle Study Questions – Discussions of analytical results and observed releases are presented in Section 4.0 and 6.0, HRS targets are discussed in Section 5 and, groundwater flow patterns in Section 2.1.5.

Decision Statement:

- 1) Do the contaminants exceed background or regulatory standards?

W0004.1A.00115

- 2) If contamination of environmental media is found in excess of benchmarks protective of human health and/or the environment and/or HRS scoring ranks the site as eligible for NPL, then options for further site characterization, remediation, or alternative uses of the site could be recommended.
- 3) What are the potential exposure pathways?

Assessment Responses to Decision Statements – Discussions of analytical results and regulatory exceedances are presented in Section 4.0 and 6.0, HRS scoring is present in the HRS Quickscore (under separate cover), and potential exposure pathways are discussed in Section 4.6.

3. Identify Information Inputs

Identification of information inputs is necessary to determine aspects of data that need to be measured in order to support the decision statements. The main components to this step consist of the following:

- Identification of the types and sources of information needed to support decision statements.
- Specification of inputs that require new environmental data.
- Determination of the appropriate sampling and analytical methods.

Information and actions required to resolve the study question(s): Groundwater elevations were obtained from all monitoring wells onsite, except TW3, TW8 and TW14, to aid in the determination of groundwater flow patterns at the Site. Laboratory analyses of soil, sediment, waste sediment, surface water, and groundwater were collected to identify if a release has occurred. The following are COCs for all media at the Site:

1. TAL Metals (including cyanide) (total and dissolved for groundwater and surface water);
2. Nitrate + Nitrite (groundwater and surface water);
3. Fluoride;
4. VOCs;
5. SVOCs;
6. PAHs ;
7. Pesticides;
8. PCBs.

Total TAL metals analyzed include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc, and cyanide.

W0004.1A.00115

Source(s) for information:

1. 6 co-located surface water and sediment samples were collected from Cedar Creek and downgradient of the Site at locations along the Flathead River as shown on Figure 6.
2. 3 sediment samples (including one opportunity sample) were collected from the Cedar Creek Overflow Drainage, as water was not present to collect the co-located surface water samples as shown on Figure 6.
3. 2 sediment samples were collected from the North Percolation Pond (West), as water was not present to collect the co-located surface water samples as shown on Figure 6.
4. 4 co-located surface water and waste sediment samples were collected from upgradient and downgradient locations of the Site from the North and South Percolation Ponds that are associated with industrial activities as shown on Figure 6.
5. 2 sediment samples were collected from the North Percolation Pond (West), as water was not present to collect the co-located surface water samples as shown on Figure 6.
6. 11 groundwater well samples were collected from existing wells in and around features that appeared to be associated with industrial activities as shown on Figure 5. No wells were installed as part of this investigation.
7. 5 groundwater well samples (including one upgradient of the Site) were collected from residential wells located southwest and downgradient of the Site as shown on Figure 5.
8. 5 background co-located surface water and sediment samples were collected from the locations shown on Figure 6. Four of these sample points are located on the Flathead River; 2 of the proposed locations on the river were not utilized based on inaccessibility.
9. 1 background sediment sample was collected from the Cedar Creek Overflow Drainage, as water was not present to collect a co-located surface water sample as shown on Figure 6.
10. 2 background soil samples were collected as shown on Figure 7.
11. 1 background groundwater sample was collected as shown on Figure 5.
12. 2 opportunity samples (one onsite sediment and one residential groundwater) were collected (Figures 6 and 5, respectively).
13. Groundwater elevations were obtained from all monitoring wells onsite, except TW3, TW8 and TW14, to aid in the determination of groundwater flow patterns at the Site (Figure 2).
14. Analytical results of collected surface water samples.
15. Analytical results of collected groundwater samples.

W0004.1A.00115

16. Analytical results of collected sediment samples.
17. Analytical results of collected waste source samples.
18. Analytical results of collected soil samples.

Confirm that measurement methods exist to provide data: Definitive analytical methods used for groundwater, surface water, soil and sediment matrices samples include EPA Method ISM01.3 (TAL metals including mercury and cyanide), EPA Method SOM01.2 (VOCs, SVOCs, PAHs, pesticides, and PCBs), and EPA Method 300.0 (Fluoride and nitrate/nitrite as N).

4. Define the Boundaries of the Study

Specify the spatial and temporal aspects of the environmental media that the data must represent to support the decision.

Specific characteristics that define the population being studied: The specific characteristics of the population being investigated are the concentrations of the contaminants in samples collected from soil, sediment, waste sediment, surface water, and groundwater at the Site.

Spatial boundary of the decision statement: The spatial boundaries of the study area are defined by the disturbance areas at the Site. Surface water samples were collected from the Flathead River, Cedar Creek, and the percolation ponds. Cedar Creek Reservoir Overflow Drainage and the North Percolation Pond (West) were dry and thus, no surface water samples were collected. Groundwater samples were collected from existing onsite wells, residential wells within Aluminum City and upgradient of the Site. Groundwater samples were collected relative to the potential source areas at the Site.

The vertical boundary of soil, sediment, waste sediment sampling is 0 to 6 inches bgs. The vertical boundary of surface water samples is 0 to 1 foot below the water surface. The vertical boundary of groundwater samples is the depth below the water surface at which the dedicated pumps are installed and varied by well.

Temporal limit and scale of inference of the decision statement: Groundwater fluid elevations, groundwater and surface water field screening parameters, and groundwater, surface water, sediment, and soil samples were collected during a single site visit, which occurred between September 24 and October 1, 2013.

Practical constraints on data collection: Collection of surface water samples was contingent on water being present in Cedar Creek, Cedar Creek Reservoir Overflow Drainage, and the North and South Percolation Ponds. Water was not present in Cedar Creek Reservoir Overflow Drainage and the North Percolation Pond (West) and therefore, no surface water samples were collected from these locations. However, the Cedar Creek Reservoir Overflow Drainage is upgradient of Site and waste sources and surface water for the North Ponds was subsequently evaluated via the surface water samples collected from the North Percolation Pond (East).

Physical conditions and safety considerations restricted access and prevented the collection of planned co-located surface/sediment samples CF-SW/SD-10 through CF-

W0004.1A.00115

SW/SD-12 located downgradient and adjacent to the Site on the Flathead River between CF-SW/SD-09 and background sample CF-SW/SD-13 locations (Figure 6). However, assessment of contaminant migration to the Flathead River was accomplished through the collection of co-located surface water and sediment samples (CF-SW/SD-05 through CF-SW/SD-09) located downgradient and adjacent to the Site.

Collection of groundwater samples was contingent on water being present within the wells; all planned groundwater samples were collected.

Scheduling adjustments were made to accommodate the collection of all samples by extending the sampling schedule to October 1, 2013. Access to the residential wells and the Site itself were through private property. Access agreements were coordinated through the EPA and property owners and were obtained prior to sample collection activities. If necessary, field personnel were escorted during sampling activities.

5. Develop the Analytic Approach

Development of an analytical approach involves the designation of benchmarks and use in evaluating decision rules. Each decision rule is a logical “if...then” statement defining conditions that would cause the decision maker to choose among alternative actions. The analytical approach for the study will utilize threshold values as the population parameter for decision making. The thresholds will be used as Benchmarks for soil, sediment, and water.

Develop a logical “if...then” statement that defines the conditions that would cause the decision maker to choose among alternative actions.

Benchmarks:

Preliminary screening benchmarks for TAL metals (including cyanide), fluoride, VOCs, SVOCs, PAHs, PCBs, and pesticides in soil, sediment and waste sediment are the Superfund Chemical Data matrix (SCDM) levels and EPA Regional Screening Levels (RSLs) for residential and industrial soil (Appendix E).

Preliminary screening benchmarks for TAL metals (including cyanide), fluoride, VOCs, SVOCs, PAHs, PCBs, and pesticides in surface water are the SCDM levels and MT DEQ’s Water Quality Standards (Appendix E).

Preliminary screening benchmarks for TAL metals (including cyanide), fluoride, VOCs, SVOCs, PAHs, PCBs, and pesticides in groundwater are the SCDM levels, EPA RSLs for tap water, and MT DEQ’s Water Quality Standards (Appendix E).

Decision Rules:

- 1) Where an observed release is indicated, data were compared to appropriate regulatory standards and are identified in Section 4.0 if any one of the following occurred:
 - Laboratory analyses of the downstream sediment sample are equal to or greater than three times the upstream sediment sample(s).

W0004.1A.00115

- Laboratory analysis of surface water and groundwater samples is equal to or greater than the upstream/upgradient concentrations.
- Laboratory analyses of any samples are a “detect” if the background sample is a non-detect.

All laboratory data packages were verified and validated using a Stage 4 validation, as described in the: EPA *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (January 2009) (QAPP, Appendix N); Sampling and Analysis Plan for Columbia Falls Aluminum Company (September, 2013); EPA CLP Statement of Work for Inorganic Superfund Methods, ISM01.3 (May, 2005); National Functional Guidelines for Superfund Organic Methods Data Review (June, 2008); MECX Data Validation Procedure for General Minerals (DVP-6, Rev. 0), EPA SW-846 Methods; National Functional Guidelines for Inorganic Superfund Data Review (January, 2010); National Functional Guidelines for Superfund Organic Methods Data Review (June, 2008).

6. Specify Performance or Acceptance Criteria

Specify the decision as a statistical hypothesis test, examine consequences of making incorrect decisions from the test, and place acceptable limits on the likelihood of making decision errors.

Determine the possible range of the parameter(s) of interest: Use of biased sampling points such as potential hot spots as indicated by previous investigations and site features, or stream/riverbed samples adjacent to industrial site features, precludes statistical determination of limits on decision errors. Measurement error, rather than sampling error, is deemed the primary factor affecting any decision error. Verified and validated definitive data was evaluated for measurement error. Sampling error is limited to the extent practicable by following approved EPA methods and applicable standard operating practices. Sampling error and tolerable limits cannot be quantified.

7. Develop the Detailed Plan for Obtaining Data

Identify the most resource-effective sampling and analysis design for generating data that are expected to satisfy the Data Quality Objectives (DQOs).

Sample locations were selected based on historic industrial practices to identify the presence and approximate extent of contamination. Sediment, surface water, and groundwater sample locations were located in upstream/upgradient and downstream/downgradient locations relative to the Site as well as adjacent to specific industrial site features that have the potential of impacting the watershed.

W0004.1A.00115

5.0 MIGRATION PATHWAY ANALYSIS

The following sections describe and discuss the physical conditions, migration pathway targets, releases or potential releases and results of samples collected during the investigation. Four migration pathways, evaluated based on EPA guidance, are presented:

- Groundwater migration (drinking water)
- Surface water migration (drinking water, human food chain, sensitive environments)
- Soil exposure (resident population, nearby population, sensitive environments)
- Air migration (population, sensitive environments)

5.1 SOURCES OF CONTAMINATION

A contaminant source is defined as an area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. Based on the results of sampling conducted as part of this Site Reassessment, potential sources of contamination are the percolation ponds and landfill material. There may be other sources not sampled and evaluated during this site reassessment. A description of these areas and their historic uses are described in Section 2.3 Table 1.

The landfills and waste ponds are located in the center of the Site just north of the plant and comprise a total of approximately 72 acres. Contaminants expected to be present in these landfills and waste ponds are aluminum, sodium, nickel, chromium, beryllium, copper, zinc and other metals, VOCs, SVOCs, pesticides, PAHs, PCBs, coal tar, cyanide, fluoride, alumina, calcium, and briquette coke and pitch condensate solids. Source contaminant concentrations from materials present in the landfills and waste ponds are being evaluated through groundwater, as directly sampling the landfills and waste ponds would compromise the integrity of the caps or covers and potentially cause a release of contaminants to the environment. A total of six groundwater samples (CF-GW-MW-02 through CF-GW-MW-07) were collected adjacent to the landfills and waste ponds (Figure 5). Concentrations of metals, fluoride, and Nitrate/Nitrite as N were detected above the reporting limits in groundwater samples collected adjacent to the landfills and waste ponds as discussed in Section 4.1.1.

The percolations ponds combined consist of approximately 70 acres in the center and south end of the Site. The North Percolation Ponds total approximately 8 acres and are expected to contain contaminants such as nickel (present in petroleum coke), chromium, beryllium, copper, zinc (used to manufacture aluminum metal alloys), suspended solids, soluble oils, coal tar, lube oil, aluminum, antimony alumina and carbon solids, soluble fluoride, battery acid, grease, and solvent residues. A total of five (including one duplicate) source soil samples (CF-WS-17 through CF-WS-20 and CF-WS-25) were collected from the North Percolation Ponds. Three (including one duplicate) source surface water samples (CF-SW-19, CF-SW-20 and CF-SW-25) were collected from the North Percolation Pond (East). Concentrations of SVOCs, metals, and fluoride were detected above the reporting limit in surface water samples collected from the North Percolation Pond (East) as discussed in Section 4.1.2.1. No water was present in the North Percolation Pond (West) to sample. SVOCs, pesticides, metals, and fluoride were detected in

W0004.1A.00115

sediment samples at concentrations above the reporting limits in waste sediments collected from both North Percolation Ponds as discussed in Section 4.1.2.2. Sample locations are shown in Figure 6.

The South Percolation Ponds compose approximately 62 acres and are expected to contain contaminants such as soluble oils, chlorine, and treated sewage, alumina and carbon suspended solids, soluble fluoride, hydraulic oil, benzo(a)pyrene, antimony, nickel, aluminum, and fluoride. A total of two co-located source surface water and soil samples (CF-SW/WS-21 and CF-SW/WS-22) were collected from the South Percolation Ponds (Figure 6). Concentrations of SVOCs, metals, and fluoride were detected above the reporting limit in surface water samples collected from the South Percolation Ponds as discussed in Section 4.1.3.1. SVOCs, pesticides, metals, and fluoride were detected in sediment samples at concentrations above the reporting limits in waste sediments collected from the South Percolation Ponds as discussed in Section 4.1.3.2.

5.2 GROUNDWATER PATHWAY

The groundwater migration pathway evaluates: 1) the likelihood that sources at a site actually have released, or potentially could release, hazardous substances to groundwater; 2) the characteristics of the hazardous substances that are available for a release (i.e., toxicity, mobility, and quantity); and 3) the receptors (targets) who actually have been, or potentially could be, impacted by the release. For the targets component of the evaluation, the focus is on the number of people who regularly obtain their drinking water from wells that are located within 4 miles of the site. The emphasis is on drinking water usage over other uses of groundwater (e.g., food crop irrigation and livestock watering) because, as a screening tool, it is designed to give the greatest weight to the most direct and extensively studied exposure routes.

An observed release is indicated when there is an exceedance of three times the calculated background concentration or when an analyte is found at a concentration greater than the analytical reporting limit of the background sample if background levels are non-detect. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996).

Ten onsite groundwater samples (CF-GW-MW-02 through CF-GW-MW-11) were collected from groundwater monitoring wells located downgradient of the landfills and waste ponds (Figure 5). An observed release to groundwater has been documented for aluminum, arsenic, chromium, cobalt, copper, cyanide, iron, lead, nickel, potassium, selenium, sodium, vanadium, zinc, fluoride, and nitrate/nitrite as N in the onsite groundwater monitoring wells with the highest concentrations primarily occurring in CF-GW-MW-02, CF-GW-MW-03, and CF-GW-MW-09 as discussed in Section 4.2.2. The Site groundwater analytical results for CF-GW-MW11 were also compared to the SCDMs Drinking Water Standards, the MT DEQ WQS for Human Health, and the EPA Tapwater RSLs since this is an onsite production well used for potable water. An observed release to groundwater has been documented for zinc and fluoride; however, the concentrations do not exceed any of the human health screening benchmarks (Section 4.2.2). No other analytes were detected at concentrations that met observed release criteria.

W0004.1A.00115

A total of five residential groundwater samples were collected during this investigation to include four groundwater samples (CF-GW-MW-12 through CF-GW-MW-15) collected from locations downgradient and west of the Site and one opportunity groundwater sample (CF-GW-OP-02) collected from upgradient and north-northwest of the Site (Figure 5). An observed release to residential groundwater has been documented for aluminum, barium, copper, cyanide, manganese, potassium, zinc, and nitrate/nitrite as N; however, only cyanide also exceeds one or more of the human health screening benchmarks (Section 4.2.3). No other analytes were detected at concentrations that met observed release criteria.

5.2.1 Groundwater Receptors

Groundwater is used as the primary source of drinking water in the City of Columbia Falls. According to a query of the Montana Bureau of Mines and Geology (MBMG) Montana Groundwater Information Center database, 533 wells were reported within an approximate four-mile radius of the Site within Flathead County (Department of Natural Resources and Conservation [DNRC], 2013). Of the 533 wells, depth to water was reported for all but 15 of the wells and ranged between 12 to 620 feet bgs with an average depth to water of approximately 164 feet bgs (DNRC, 2013). The water uses for wells located within the approximate four-mile radius are presumed to be private domestic wells used for drinking water and two public supply wells (DNRC, 2013). There are five private domestic wells located approximately 3 miles from the Site that participate in the MBMG statewide groundwater monitoring network and whose water quality is tested (Montana Tech of the University of Montana, 2013). The average number of persons per household in Flathead County, Montana, is 2.43 (U.S. Census Bureau, 2010). Domestic wells within four miles of the site and the population served are listed in Table 3.

Table 3 Wells within Four-Mile Radius and Population Served

Radius	Number of Domestic Wells	Estimated Domestic Population	Number of Municipal Wells	Estimated Municipal Population
0 - 0.25	13	32	0	0
0.25 - 0.50	5	13	0	0
0.50 - 1.0	13	32	0	0
1.0 - 2.0	99	241	0	0
2.0 - 3.0	102	248	0	0
3.0 - 4.0	299	727	2	2527
Total	533	1296	2	2527

The City of Columbia Falls utilizes two municipal ground water wells as a primary potable water supply (alternating between the two for approximately 50% utilization on each) for 1,040 connections (Lawry, 2013; Nicosia, 2013). The two municipal wells (Louisiana Pacific Well and Clare Park Well) are located within the Columbia Falls city limits (Nicosia, 2013). The Clare Park Well is located approximately 0.5 miles west of the Flathead River and approximately 3.22 miles downgradient of the Site and is 304 feet deep (Montana Tech of the University of Montana, 2013). The second well (Louisiana Pacific Well) is located approximately 1.8 miles

W0004.1A.00115

west of the Flathead River and approximately 3.4 miles downgradient of the Site and is 231 feet deep (Montana Tech of the University of Montana, 2013).

5.2.2 Groundwater Pathway Conclusions

Depth to groundwater on-site, as measured during the groundwater elevations sweep, averages approximately 72.4 feet bgs. There is one on-site groundwater well currently being used for drinking water; however, there are no on-site residents, schools, daycares, or sensitive environments within 200 feet of the Site. The MBMG database indicates there are 32 domestic wells within ¼-mile of the Site and a total of 1296 domestic wells within 4 miles of the Site that are presumably used for drinking water. The average depth to water of the residential wells is approximately 164 feet bgs. Based on readily available information regarding current potential receptors and the groundwater sampling performed as part of this investigation, groundwater appears to be impacted.

5.3 SURFACE WATER PATHWAY

An observed release to surface water is documented when there is an exceedance of three times the calculated background concentration or when an analyte is found at a concentration greater than the analytical reporting limit of the background sample if background levels are non-detect. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996).

In addition to background surface water samples, surface water was collected downstream in Cedar Creek (CF-SW-03) west of the Site and in the Flathead River (CF-SW-05 through CF-SW-09) adjacent to and downgradient of the Site as shown in Figure 6. Laboratory analyses of cyanide, copper, and potassium in the Cedar Creek sample are greater than their respective three times background concentration indicating an observed release of these metals has occurred. Of these metals, cyanide was detected in concentrations exceeding the SCDM and MT DEQ Aquatic Life screening benchmarks. No other analytes were detected at concentrations that met observed release criteria.

In the Flathead River, analyses of manganese and sodium (CF-SW-07 and CF-SW-23 [duplicate]), zinc (CF-SW-05 and CF-SW-09), and fluoride (CF-SW-07 and CF-SW-23 [duplicate]) in the river surface water samples, and cyanide and fluoride in the sediment samples (CF-SD-07 and CF-SW-23 [duplicate]) adjacent to and downgradient of the Site are greater than their respective three times background concentration indicating an observed release of these metals has occurred. No other analytes were detected at concentrations that met observed release criteria.

5.3.1 Surface Water Receptors

The CFAC Site has the potential to impact the Flathead River due to its hydrologic position upgradient of the river and upstream of the Flathead River-Columbia Falls Watershed. The most downstream observed release and the start of the 15-mile target distance limit is the sample location for CF-SW/SD-07. Site groundwater discharge point (Outfall D006) located at the

W0004.1A.00115

RIV-2 point in Figure 2 (MT DEQ, 1999) is the probable point of entry. There is a potential for the Cedar Creek overflow Drainage Ditch, which is located approximately 1 mile east of Outfall D006, to be a probable point of entry; however, confirmation of its connection to the Flathead River was not obtainable during this investigation. The 2013 average annual discharge of the Flathead River as measured from the USGS gaging station (#12363000) located south and adjacent to the City of Columbia Falls was 10,210 cubic feet per second (USGS, 2014). No stream flow data was available for Cedar Creek; however, field estimates put the flow rate at approximately 2 cubic feet per second. There are 14 diversions on the Flathead River within the 15-mile downstream segment consisting of 3 municipal, 3 irrigation, 4 industrial and 4 fish and wildlife (DNRC, 2013). The three diversions classified as municipal consist of two dams and one head gate and are therefore not used for drinking water (DNRC, 2013).

Fish production data indicate that lake, rainbow, bull, brown, Westslope cutthroat, and brook trout, as well as black bullhead, kokanee, lake whitefish, largemouth bass, largescale sucker, longnose dace, longnose sucker, mottled sculpin, mountain whitefish, northern pike, northern pike minnow, peamouth, pumpkinseed, pygmy whitefish, reidside shiner, slimy sculpin, smallmouth bass, and yellow perch are all present in the Flathead River (MSP, 2014). According to Montana Fish, Wildlife & Parks Fisheries Biologist, Mark Deleray, fish are consumed from this stretch of the Flathead River as well as within the 15-mile downstream target distance limit of the Flathead River (Deleray, 2014a). FWP allows harvesting of fish from Cedar Creek, but cannot confirm if they are subsequently consumed (Deleray, 2014b). No connection of Cedar Creek to the Flathead River was able to be confirmed during this investigation. As mentioned in Section 2.2.1.1, the ECOS and FWP Threatened Species lists 12 different species (two fish and seven mammals, one insect, one flowering plant, and one conifer) are present in Flathead County that are considered federal or state listed threatened, endangered, or sensitive species that appear to have potential critical habitat that may be present onsite and/or overlap the Site boundary. The ECOS and MFISH identified habitat for the Bull Trout (federally threatened) and Westslope Cutthroat Trout (federally sensitive) in the Flathead River and the Westslope Cutthroat Trout in Cedar Creek (USFWS, 2013; MSP, 2014). Fish surveys conducted by FWP have confirmed the presence of both species in the Flathead River adjacent to the Site and the presence of Westslope Cutthroat Trout in Cedar Creek (MSP, 2014; Deleray, 2014b).

According to the Montana National Heritage Program's (MNHP) Map Viewer-Wetland and Riparian Mapping database, approximately 30 miles (15 miles on both sides of the river) of streamside wetlands are present from the site along the Flathead River downstream 15 miles. The dominant vegetation is riparian lotic forested, intermixed with freshwater palustrine scrub-shrub and riparian lotic emergent wetlands, and pockets of riparian lotic scrub-shrub and freshwater palustrine emergent wetlands. These wetland types are also found onsite in the areas surrounding the South Percolation Ponds at the southern end of the site and adjacent to the Flathead River. In addition, the MNHP identifies the North and South Percolation Ponds as freshwater, palustrine, semi-permanently flooded ponds. (MNHP, 2014)

5.3.2 Surface Water Pathway Conclusions

Based on readily available information regarding current potential receptors and the surface water sampling performed as part of this investigation, surface water appears to be impacted.

W0004.1A.00115

5.4 SOIL EXPOSURE AND AIR PATHWAYS

For the soil and air pathways evaluations, the focus is on populations that are regularly and currently present on or within 200 feet of surficial contamination. The four populations that receive the most weight are residents, students, daycare attendees, and terrestrial sensitive environments.

In addition to background soil samples (CF-SS-01 and CF-SS-02), six soil samples (CF-SS-03 through CF-SS-08) were collected upwind of the plant, adjacent to the plant, downwind of the plant, and downwind and across the Flathead River offsite (Figure 7). An observed release to soil is documented when there is an exceedance of three times the calculated background concentration or when an analyte is found at a concentration greater than the analytical reporting limit if background levels are non-detect. If the result is flagged with a J, the matrix factor was applied as described in EPA guidance *Using Qualified Data to Document an Observed Release and Observed Contamination* (EPA, 1996). Laboratory results for soil samples (CF-SS-05 through CF-SS-07) indicate that soils adjacent to the plant are impacted by elevated levels of fluoride that exceed the three times background concentration.

5.4.1 Soil and Air Exposure Pathway Receptors

There are no schools, daycare centers, or regularly occupied residences within 200 feet of the soil exposure source area. The closest resident, based on a review of Google Earth aerial photographs, appears to be approximately 0.35 miles from the Site. The Site is only accessible through private property and is partially fenced. The aluminum plant and immediate surrounding areas are fenced by a 10-foot high chain-link fence; however, not all access gates are chain-link fence. The access gate located north of the parking lot is a single chain gate that restricts vehicular access. The only 24-hour monitored gate is the main gate located at the Administration building at the plant entrance. The North Percolation Pond (West) is surrounded by a 10-foot high chain-link fence. The Industrial Landfill located north of the plant is surrounded by a 10-foot high chain-link fence; however, during the field activities the gates were observed to remain open. The northern portion of the Site has gates at access points on the roads restricting vehicular access to the Site. The southern portion of the Site (including south of the Flathead River) is not fenced. Access to the portions of the Site including the North Percolation Pond (East), Industrial Landfill, and South Percolation Ponds may pose a threat to wildlife (bears, deer, elk, moose, birds). Teakettle Mountain to the east and the Flathead River to the South include the Site boundaries.

W0004.1A.00115

Table 4 Population within Four-Mile Radius

Radius	Population
0 - 0.25	11
0.25 - 0.50	19
0.50 - 1.0	264
1.0 - 2.0	1105
2.0 - 3.0	2781
3.0 - 4.0	5596
Total Population	9776

As mentioned in Section 2.2.1.1, the ECOS and FWP Threatened Species lists 10 different terrestrial species (seven mammals, one insect, one flowering plant, and one conifer) are present in Flathead County that are considered federal or state listed threatened, endangered, or sensitive species that appear to have potential critical habitat that maybe present onsite and/or overlap the Site boundary or would potentially be impacted by conditions at the Site. The species associated with the study area include the Meltwater Lednian stonefly, Spalding's Catchfly, Grizzly Bear, Gray Wolf, Canada Lynx, Black-footed Ferret, Northern Bog Lemming, North American wolverine, Fisher, and Whitebark pine.

A site-specific biological assessment has not been performed; therefore, it is not possible to determine if any of these species are definitively present at the Site. None of the aforementioned species were observed to be present during the current site investigation activities. Likewise, the above list is not to be considered a comprehensive list of possible threatened and endangered species that may be present on the Site.

As mentioned in Section 5.3.2, the wetland areas onsite consist of riparian lotic forested, intermixed with freshwater palustrine scrub-shrub and riparian lotic emergent wetlands, and pockets of riparian lotic scrub-shrub and freshwater palustrine emergent wetlands. These wetland types are also found onsite in the areas surrounding the South Percolation Ponds at the southern end of the site and adjacent to the Flathead River. In addition, the MNHP identifies the North and South Percolation Ponds as freshwater, palustrine, semi-permanently flooded ponds. (MNHP, 2014) The acreages of wetlands located within a four-mile radius of the site are listed in the Table 5 (MNHP, 2013):

Table 5 Acres of Wetland within Four-Mile Radius

Radius	Wetland Acreage (Approximate)
0 - 0.25	131
0.25 - 0.50	107
0.50 - 1.0	126
1.0 - 2.0	199
2.0 - 3.0	344
3.0 - 4.0	227

W0004.1A.00115

5.4.2 Soil and Air Exposure Pathway Conclusions

The air pathway is being evaluated indirectly through the evaluation of soil at the Site, as no air samples were collected during this investigation. This investigation intended to evaluate the potential concern of aerial deposition of fluoride from past emissions as a result of plant processes. There is limited potential for soil particles to migrate off-site from ponds and then having an adverse effect on humans or ecological receptors. There are no schools, daycare centers, or regularly occupied residences on-site. The closest resident, based on a review of Google Earth aerial photographs, appears to be approximately 0.35 miles from the Site. Based on readily available information regarding current potential receptors and the limited soil sampling performed as part of this investigation, the potential impact to soil and air appears to be low.

W0004.1A.00115

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6.0 INVESTIGATION SUMMARY

The Columbia Falls Aluminum Company Site is located northeast of the City of Columbia Falls, Montana and is associated with historical aluminum smelting operations. The plant produced aluminum steadily from 1955 to 2009. The objectives of this investigation were to:

- Characterize the hydrogeological conditions at the Site.
- Evaluate source area(s) and contaminant characteristics of source area(s) at the Site
- Collect samples and associated analytical data to confirm a release, or threat of a release of a hazardous substance to the environment.
- Identify the contaminants of concern (COCs).
- Identify the potential targets or receptors (human and ecological) that may be impacted, and pathways by which they may be or are being transmitted.
- Determine if potential targets or receptors have potential or actual contamination.

A total of 68 groundwater, surface water, sediment and soil samples were collected at the Site and surrounding areas from September 25 – October 1, 2013 and submitted for laboratory analysis. All Groundwater, surface water, sediment, waste sediment, and three soil samples (CF-SS-01, CF-SS-02, and CF-SS-09 [duplicate of CF-SS-02]) were submitted to the laboratory for Contract Laboratory Program (CLP) analysis of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls (PCBs), total and dissolved Target Analyte List (TAL) metals, fluoride, and nitrate/nitrite as N (water samples only). Five soil samples (CF-SS-03 through CF-SS-08) were only analyzed for fluoride to determine the potential impact of aerial deposition of fluoride emissions. Of these 68 samples, two groundwater, six surface water, seven sediment, and three surface soil samples were collected from background locations; the laboratory analytical results of which were used to evaluate if observed release conditions are met.

Analytical results were compared to three times the background concentration per Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) guidance to establish if an observed release has occurred at the Site. Sample soil and sediment analytical results were also compared to risk-based screening criteria including the Superfund Chemical Data Matrix (SCDM) Reference Dose Screening Concentration (RDSC) and Cancer Risk Screening Concentration (CRSC) and EPA Regional Screening Levels (RSLs). Surface water and groundwater sample analytical results were compared to Montana Numeric Water Quality Standards in addition to the aforementioned screening criteria. The following summarizes results and findings of the current investigation and conclusions drawn.

Source Areas

- The hazardous materials associated with the landfill and waste pond sources (identified by groundwater monitoring wells) have been identified in groundwater samples at significantly elevated concentrations for aluminum, arsenic, calcium, chromium, cobalt, copper, cyanide, iron, lead, magnesium, include aluminum, arsenic, chromium, barium,

W0004.1A.00115

calcium, chromium, cobalt, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, vanadium, zinc, fluoride, and nitrate/nitrite as N

- Analytical results of source surface water samples associated with the North Percolation Ponds source indicate observed concentrations of chrysene, fluoranthene and pyrene, aluminum, arsenic, barium, calcium, copper, cyanide, iron, lead, magnesium, manganese, nickel, sodium, vanadium, zinc, and fluoride.
- Analytical results of source surface water samples associated with the two South Ponds source indicate observed concentrations of dimethylphthalate, aluminum, arsenic, barium, calcium, chromium, cobalt, copper, cyanide, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium, zinc, and fluoride.
- Analytical results of source sediment samples associated with the North Percolation Ponds source indicate observed concentrations of SVOCs (anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, carbazole, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene), pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, beta-bhc, dieldrin, endosulfan I, endosulfan II, endosulfan sulfate, endrin, endrin aldehyde, endrin ketone, gamma-chlordane, heptachlor epoxide, and methoxychlor), TAL metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, sodium, thallium, vanadium, and zinc), and fluoride.
- Analytical results of source sediment samples associated with the South Percolation Ponds source indicate observed concentrations of benzo(b)fluoranthene, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, and pyrene, endrin ketone and gamma-chlordane, aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, copper, cyanide, iron, lead, magnesium, manganese, mercury, nickel, potassium, sodium, vanadium, zinc, and fluoride.

Groundwater Monitoring Wells

- Analytical results of the onsite groundwater monitoring wells samples indicate observed release concentrations of aluminum, arsenic, chromium, cobalt, copper, cyanide, iron, lead, nickel, potassium, selenium, sodium, vanadium, zinc, fluoride, and nitrate/nitrite as N above three times background and are attributable to the Site, as they were detected above the reporting limit in source samples.
- Analytical results of the onsite groundwater monitoring wells samples indicate observed concentrations of dichlorodifluoromethane and 4-methylphenol that exceed the three times background concentration, but were not detected in any of the source samples.

Residential Groundwater Receptors

- Analytical results of the residential groundwater wells samples indicate observed concentrations of aluminum, barium, copper, cyanide, manganese, potassium, zinc, and

W0004.1A.00115

nitrate/nitrite as N that exceed the three times background concentrations; however, only cyanide also exceeds the EPA Tapwater RSL human health screening benchmark.

- Analytical results of the residential groundwater wells samples indicate an observed concentration of naphthalene that exceeds the three times background concentration and the EPA Tapwater RSL benchmark, but is not attributable to the Site, as it was not detected above the reporting limit in any of the source samples.

Cedar Creek Receptors

- Analytical results of the Cedar Creek surface water samples indicate observed concentrations of copper, cyanide, and potassium above three times background and are attributable to the Site, as they were detected above the reporting limit in source samples. Of these, cyanide exceeds the three times background concentration and all of the SCDM and MT DEQ Aquatic Life WQS benchmarks.

Flathead River Receptors

- Analytical results of the Flathead River surface water samples indicate observed concentrations of manganese, sodium, zinc, and fluoride above three times background and are attributable to the Site, as they were also detected in source samples.
- An analytical result of the Flathead River surface water samples indicate an observed concentration of carbon disulfide above three times background, but is not attributable to the Site, as it was not detected in any of the source samples.
- Analytical results of the Flathead River sediment samples indicate observed concentrations of cyanide and fluoride that exceed the three times background concentrations and are attributable to the Site, as they were also detected in source samples.

Soil Receptors

- Analytical results of soil samples indicate observed concentrations of fluoride above the three times background concentration and are attributable the Site, as they were also detected in source samples.

6.1 CONCLUSIONS

Based on a comparison of onsite and offsite data to background concentrations, an observed release of metals and inorganics in groundwater, metals and inorganics in surface water, cyanide and fluoride in sediments, and fluoride in soils greater than background levels and/or human health and/or ecological screening levels. Based on evaluation of the analytical data collected during the SR, these media have been impacted by historic plant processes.

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7.0 REFERENCES

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
CFAC, 2002	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Delaray, Mark, 2014a. Fisheries Biologist, Montana Fish, Wildlife & Parks, Kalispell, MT. Personal Communication, February 11, 2014.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Delaray, 2014a	Communication	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Delaray, Mark, 2014b. Fisheries Biologist, Montana Fish, Wildlife & Parks, Kalispell, MT. Personal Communication, March 19, 2014.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Delaray, 2014b	Email	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Doyle, 2013	Communication	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
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W0004.1A.00115

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
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		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Montana Tech of the University of Montana, 2013	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Lawry, Lorin, 2013. Director of Public Utilities, City of Columbia Falls. Personal Communication, June 3, 2013.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Nicosia, 2013	Email	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Montana Department of Environmental Quality (MT DEQ), 2013. *Sampling and Analysis Plan for Columbia Falls Aluminum Company, Aluminum Smelter Facility, Columbia Falls, Flathead County, Montana*. Weston Solutions. Comments on Draft SAP, August 22, 2013.

W0004.1A.00115

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
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Citation	Reference Type	Assessment Factor				
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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
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MT DEQ, 1998. Permit Renewal and Mixing Zone Application, CFAC. July 31, 1998.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
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MT DEQ, 1994. Permit Renewal and Mixing Zone Application, CFAC. October, 1994.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
MT DEQ, 1994	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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		Soundness	Applicability	Clarity and	Uncertainty and	Evaluation

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			and Utility	Completeness	Variability	and Review
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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
NMHP, 2014	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
MNHP, 2013	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
MSP, 2014	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
MSP, 2013	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Nicosia, Susan, 2013. City Manager, City of Columbia Falls, Personal communication with Robert Parker, EPA Region 8, September 25, 2013.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Nicosia,	Email	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Olympus Environmental, Inc., 1992. *Remedial Activities Report for Transformer Oil Spill at Columbia Falls Aluminum Company, Columbia Falls, Montana*. April 14, 1992.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Olympus Environmental, Inc., 1992	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Townsend, 2013	Email	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
U.S. Census Bureau, 2010	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
EPA, 2014	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
EPA, 2013	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

EPA, 1996. *Using Qualified Data to Document and Observed Release and Observed Contamination.* Office of Solid Waste and Emergency Response (OSWER). November 1996.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
EPA, 1996	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

EPA, 1993. *Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA.* OSWER. January 1993.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
EPA, 1993	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

EPA, 1992. *Guidance for Performing Site Inspections Under CERCLA, Interim Final.* OSWER. Directive 9345.1-05. EPA540-R-92-021. September 1992.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
EPA, 1992	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

EPA, 1984. *Aerial Photographic Analysis of Waste Study Sites, Montana.* EPA Region 8. November, 1984

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
EPA, 1984	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

U.S. Fish and Wildlife Service (USFWS), 2014. *Information, Planning, and Conservation System (IPaC).* <http://ecos.fws.gov/ipac/>. Accessed January 21, 2014.

Citation	Reference	Assessment Factor				
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	Type	Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
USFWS, 2014	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

USFWS, 2013. *Environmental Conservation Online System*. www.ecos.fws.gov. Accessed November 28, 2013.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
USFWS, 2013	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
USGS, 2014	Website	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
WESTON, 2013a	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
WESTON, 2013b	Document	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
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Wright, Steve, 2001. Environmental and Laboratory Manager, CFAC. Letter to Mr. William Potts, Air & Waste Management Bureau, Montana Department of Environmental Quality, 27 November 2001.

Citation	Reference Type	Assessment Factor				
		Soundness	Applicability and Utility	Clarity and Completeness	Uncertainty and Variability	Evaluation and Review
Wright, 2001	Letter	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

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FIGURES

APPENDIX A
Well Logs

APPENDIX B
Photograph Log

APPENDIX C
Field Data Tables

APPENDIX D
Field Documentation

APPENDIX E
Data Summary Tables

APPENDIX F
Laboratory Analytical and Data Validation Reports
